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Economic Analysis of Hunting of Selected Big Game Species in the Eastern Slopes of Alberta

by

©

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Economic Analysis of Hunting of Selected Big Game Species in the Eastern Slopes of Alberta submitted by Wiktor L. Adamowicz in partial fulfilment of the requirements for the degree of Master of Science in Agricultural Economics.

William E Phillips
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Date August 23, 1983

Abstract

The objective of this study is to analyze the economics of big game hunting of sheep, mountain goat, grizzly bear, black bear, moose and elk, in the eastern slopes region of Alberta's Rocky Mountains. The study region encompasses portions of Alberta big game hunting zones 5 through 11.

An analysis of the dimensions of the wildlife allocation problem shows that current wildlife management systems and economic institutions are lacking in their ability to equitably and efficiently allocation wildlife resources among demanders. The lack of well defined property rights results in a lack of communication between the demanders of the resource (hunters, sightseers, campers) and the suppliers or managers of the resource, the government of Alberta.

Traditional wildlife resource economics is generally concerned with the derivation of extramarket benefit estimates for the activity. While this is an important facet of research, a more general analysis of the demand for wildlife resources is essential for making policy recommendations. A case is made for the use of the household production function approach of consumer demand theory in wildlife resource economics.

The direct (or contingent valuation) technique, the travel cost model and the hedonic price method for estimating extramarket benefits are compared for each hunter group. While the results do differ among techniques, the general trends of the results lend confidence to the estimation procedures.

Shadow prices for the household production function model are also derived and hunting intensity is discussed as an important factor in the demand for wildlife resources. In particular, sheep and goat hunters are more intense than hunters of moose, elk, black bear and grizzly bear. Even though the socioeconomic characteristics are similar for all of the hunting groups, sheep and goat hunters stand out in terms of shadow prices for hunting, extramarket benefits derived and expenditures on hunting activities.

The data for the empirical work described above were obtained from a mail questionnaire sent to resident and non-resident Alberta big game hunters. Nearly 5,000 questionnares were mailed out and approximately 52% were returned.

A theoretical analysis of the household production function approach shows how policy variables can be incorporated into economic models of wildlife resource demand.

These models provide a connection between the demand for wildlife and the major policy variable, the control of harvest. Hunters will substitute inputs in their production function to reach a desired level of hunting days, harvest and miles travelled. If hunting quality, congestion or other such factors affect the recreationist, the input structure will adjust correspondingly.

The final section of this study presents qualitative data on problems in resource management perceived by hunters and the use and potential use of the guiding and outfitting industry in the province. These data show that a potential does exist for the use of guides by resident sheep and goat hunters.

Policy recommendatons include: (1) A micro or small scale management of sheep and goat resources should be implemented to provide a connection between the supply of these resources and the demand by hunters. (2) One approach which may serve as a small scale management technique is the imposition of block guiding and encouragement of resident hunter use of guides. While this technique is appealing from a property rights standpoint, there is not enough conclusive evidence on its ability to facilitate management of sheep and goat resources. More study of these types of management schemes is required. (3) Hunters in Alberta appear to be calling for more stringent regulation of hunting activity and training and licencing procedures. (4) Economic analysis of the demand for wildlife resources must be performed on a disaggregated level so as not to mask the intensity effects of hunters of different species. (5) More study is required in the area of the economic implication of wildlife management policy. An approach like the household production function is available for the analysis of policy variables in an economic framework.

Acknowledgements

Throughout the time I have spent in the graduate program here in the Department of Rural Economy there have been many people who have helped me grow and learn. In this brief passage I hope to acknowledge those who have contributed to my education, both academically and socially.

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I. Introduction

The eastern slopes region of Alberta's Rocky Mountains is the habitat for some of the world's most sought after big game animals. Bighorn sheep, mountain goat and grizzly bear are just a few of the game animals attracting hunters to this area. There is great concern however, over the allocation of these scarce wildlife resources among various users (eg.hunters, sightseers) and the maintenence of their populations. The demands for these wildlife resources involve many different and often conflicting uses. Demands are placed on the resources by hunters or consumptive users, by non-consumptive users, and by those users who value the option of engaging in consumptive or non-consumptive use in the future. While the conflict between consumptive and non-consumptive users is clear due to their different views, there also exists conflict within each catagory. Among consumptive users for example, conflict exists between residents and non-residents of Alberta for the use of the wildlife resource. On the surface one would expect that residents are entitled to first use of the resource since they in fact are the owners of the resource but, consideration must be given to the fact that non-resident hunters are the major source of income for the guiding and outfitting industry in Alberta. Also, non-resident hunters are a source of income for various businesses throughout the province. This example illustrates only one of the many complex problems within the allocative framework now in existence. Associated with the demand for wildlife is the demand for wildlife habitat. This demand is also characterized by conflict with competing uses such as resources extraction.

A number of questions arise from this confusing situation. What is the most efficient and equitable allocation of wildlife among the various user groups ? How should wildlife habitat be allocated among competing uses ? How should wildlife resources be managed to provide benefits for future generations ? These questions indicate that an indeterminate situation exists in the allocation of wildlife resource at present.

The indeterminate situation outlined above is largely due to the fact that wildlife resource management is a public activity while most wildlife demands and associated activities are private ones. There are no clear signals between managers of the resource and the demanders. The wildlife management systems and economic institutions in existence today cannot assure an efficient and equitable allocation of resources among the various competing groups. The problem therefore is a problem of social institutions with both equity and efficiency aspects. In order to move toward a more efficient and equitable allocation of wildlife resources, the prevailing institutional structure as well as the changes that are occuring in this institutional structure must be understood. It is possible to modify economic institutions and wildife management systems and in this manner construct a more favourable allocation and distribution system.

This study analyzes the social and economic impacts of hunting activity in the eastern slopes region of Alberta. In particular, the consumptive use of six selected species, mountain goat, bighorn sheep, grizzly bear, black bear, moose and elk, are analyzed. The analysis of socioeconomic effect includes the determination of various costs and benefits incurred by hunters, the analysis of socioeconomic characteristics of hunters, summaries of hunting activity in the study area, information on the use and viability of guiding and outfitting operations in the area, estimates of hunting quality and estimates of the economic effect of hunting activity on the study area.

The items mentioned above are used to evaluate the present institutional structure and are used to derive policies that call for altered economic institutions and wildlife management systems in order to more efficiently and equitably allocate the benefits of the eastern slopes wildlife resource.

The plan of this study is as follows. The remainder of this chapter contains a background analysis of the study region and reviews past trends, conditions and policies in the region. The methodology of the study is outlined in chapter two. An overview of the theoretical aspects of the study are presented in chapter three. The collection of data and some of the empirical results are discussed in chapter four. The application of economic theory to the data collected are presented in chapter five. Chapter six contains a discussion of the qualitative aspects of the resource use issue and conclusions and policy recommendations are presented in the final chapter.

A. The Eastern Slopes

The eastern slopes can be defined as "the total mountain and foothill areas in the province from its western and northwestern borders with British Columbia and its southern border with Montana to the eastern limits of the foothills but not including the National Parks and Indian reservations."[1] In relation to some of Alberta's larger centers, the Eastern Slopes region lies just west of Lethbridge, Calgary, Whitecourt and just south of Grande Prairie. This 35,000 square mile area is home for all of the province's bighorn sheep and mountain goats and nearly all of the grizzly bears as well as large populations of elk, moose, deer, cougar and other game animals. As well, it contains a wide variety of water, land, timber, scenic and mineral resources.

The boundaries of the eastern slopes region have been defined precisely by Alberta Energy and Natural Resources. These boudaries however, do not correspond with the Wildlife Management Units (WMUs) prescribed by the Fish and Wildlife Division of Alberta Energy and Natural Resources. For the purposes of this study, the eastern slopes are redefined in terms of W.M.U.s. . The big game hunting zones and W.M.U.s outlining the eastern slopes are:

1. Big Game Zone 11: including W.M.U.s 300, 302, 304, 306, 308, 310 and 312.
2. Big Game Zone 10: including W.M.U.s 400 and 402.
3. Big Game Zone 9: including W.M.U.s 404, 406, 407 and 408.
4. Big Game Zone 8: including W.M.U. 410.
5. Big Game Zone 7: including W.M.U.s 316, 318, 411, 412, 414, 417, 418, 420, 422, 423, 426, 428, 430, 431, 432, 434, 436, 437, 438 and 439.
6. Big Game Zone 6: including W.M.U.s 440, 441, 442, 444, 445 and 446.
7. The south-western portion of Big Game Zone 5: including W.M.U.s 324, 326, 328, 330, 339, 340, 342, 344, 346, 352, 354, 356 and 429.

This area corresponds very closely to the definition of the eastern slopes outlined in *A Policy for Resource Management of the Eastern Slopes*.[2]

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[1] Environment Conservation Authority of Alberta, *Public Hearings on Land Use and Resource Development in the Eastern Slopes: Information Bulletin No. 1*. Edmonton, Alberta. 1972.

[2] Alberta Energy and Natural Resources, *A Policy for Resource Management of the Eastern Slopes*. Edmonton, Alberta. 1977.

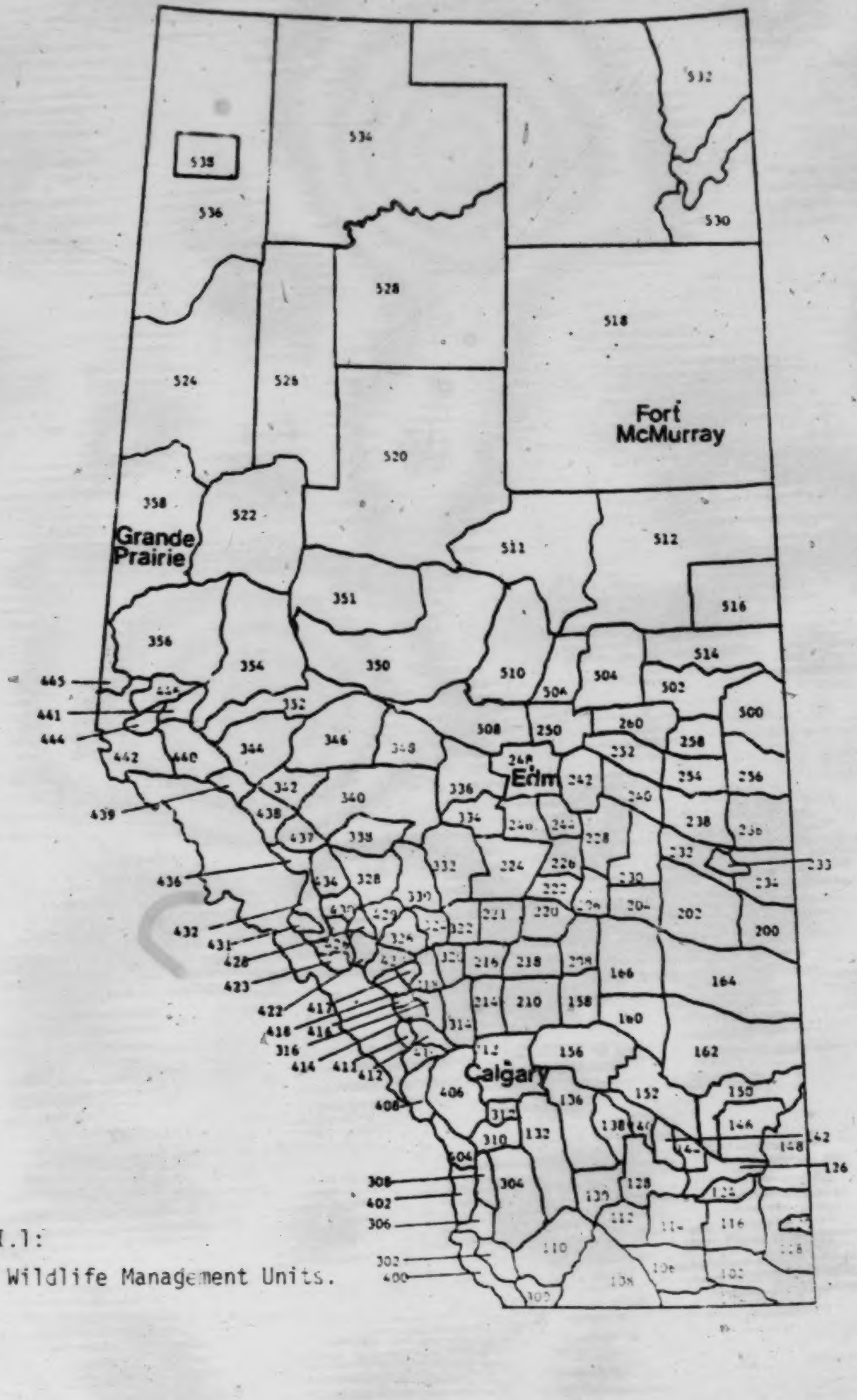
Grande Prairie
Fort McMurray
Edm
Calgary

Figure I.1:
Alberta Wildlife Management Units.

The forests of the region fall into three distinct groups. The most westerly regions are characterized by Engelmann spruce, white spruce and lodgepole pine. This area of mountainous topography shows little soil development although differences may occur due to local climatic conditions. Thin, Lithic soils are most common. This area almost perfectly corresponds to the present ranges of the bighorn sheep and mountain goat.

Slightly further east, the upper and lower foothill regions appear with lodgepole pine, trembling aspen and balsam poplar as the predominant species. Rolling topography and wide valleys characterize this region with grey luvisols as the main soil type. To the north, in the portion of Big Game Zone 5 that is within the eastern slopes boundary, exists the mixedwood forest region. Aspen and poplar are the predominate tree species, and the soils are generally luvisolic in nature.

There is great variability in the climate of the area as the Rocky Mountains cause extreme variations in rainfall and temperature regimes. Other than the high mountain areas the climatic conditions are best described as follows. Mean January temperatures range from −9 to −18 degrees C and mean July temperatures range from 11 to 17 degrees C. The frost free period in the region is approximately 60 to 80 days and the mean annual precipitation is between 450 and 600 mm. Great variation exists however as local micro-climates develop.

The region supports a wide variety of wildlife species but, as mentioned earlier, this study will deal with six in particular: bighorn sheep, mountain goat, moose, elk, grizzly bear and black bear. A short history of the hunting trends of each of these species will now be presented.

Grizzly Bear

Grizzly bear populations are located in the western and north central regions of Alberta, generally corresponding to Big Game Zones 5 through 11. The estimated population of grizzly bears in the province is between 1,000 and 1,500. The hunting season for grizzlies is held in the spring months of April, May and June. Hunting is allowed in Big Game Zones 5, 6, 7, 10, and 11. The latter two zones were only opened for grizzly hunting in the past year due to rising populations in the southern regions of the province.

Table I.1: ALBERTA GRIZZLY BEAR LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RESIDENT LICENCES SOLD	GRIZZLY BEAR HARVEST	PERCENT SUCCESS	NON RES. LIC. SOLD	GRIZZLY BEAR HARVEST	PERCENT SUCCESS
1968-69	349	----	----	----	---	---
1969-70	204	31	.15	----	----	---
1970-71	201	----	----	10	----	---
1971-72	162	4	.02	6	----	---
1972-73	219	14	.06	9	1	.11
1973-74	201	14	.06	7	1	.14
1974-75	263	11	.04	74	----	---
1975-76	373	8	.02	22	3	.14
1976-77	464	17	.04	17	4	.23
1977-78	560	----	----	----	----	---
1978-79	720	14	.02	20	7	.35
1979-80	738	14	.02	33	6	.18
1980-81	996	----	----	35	----	---

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

While licence sales have risen for grizzlies in the past few years, harvests have not (see table 1). Generally, only a few of these animals are harvested each year and the population does not seem to be declining.[3]

Black Bear

Black bears range throughout the coniferous forest region of Alberta and may be found in the parkland and other areas as well. The black bear population appears to be very healthy in Alberta and often becomes a problem by interfering with human activity, including agricultural production. Table 2 illustrates the rapid rise in Black bear licence sales but unfortunately, no statistics are available on harvest estimates. Black bears may be hunted in the fall or the spring season with a bag limit of two bears per resident hunter.

---

[3] See **Alberta Energy and Natural Resources Annual Report, 1981.** In particular the section of the report dealing with the Alberta Fish and Wildlife Division Harvest and Population Estimates.

Table I.2: ALBERTA BLACK BEAR LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RESIDENTS LICENCES SOLD	NON RES. LIC. SOLD.
1968-69	1,083	58
1969-70	1,273	54
1970-71	1,015	130
1971-72	2,815	317
1972-73	3,274	366
1973-74	4,016	434
1974-75	4,483	384
1975-76	5,662	323
1976-77	9,487	420
1977-78	10,659	487
1978-79	11,100	529
1979-80	13,182	660
1980-81	15,915	458

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Mountain Goat

The mountain goat resides at elevations above 6,500 feet, thus making it one of the most difficult game animals to hunt. Alberta's population of mountain goats is estimated at 1,200 animals and only about 45 licences are sold annually on a lottery basis. Non-resident hunting is not allowed. Table 3 contains the licence and harvest statistics for the past few years. Goat hunting is associated with a high harvest success rate.

Bighorn Sheep

Bighorn or Rocky Mountain sheep occupy a similar range to that of the mountain goat but typically stay at lower elevations. Table 4 contains a summary of licence sales and harvest rates for bighorn sheep. Notice that resident licence sales have risen in the past few years but harvest rates have remained low. Non-resident licences are limited by quota and harvest rates are typically several times higher for non-residents as compared to resident hunters of bighorn sheep. The present population of bighorn sheep is estimated at 5,000 animals with a large portion residing in the national parks.

Table I.3: ALBERTA MOUNTAIN GOAT LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RESIDENT LICENCES SOLD	GOAT HARVEST	PERCENT SUCCESS
1968-69	59	54	---
1969-70	----	----	---
1970-71	----	----	---
1971-72	75	22	.29
1972-73	52	14	.26
1973-74	53	13	.26
1974-75	53	13	.24
1975-76	55	28	.51
1976-77	48	29	.60
1977-78	50	16	.32
1978-79	46	23	.50
1979-80	47	32	.68
1980-81	42	32	.76

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Table I.4: ALBERTA BIGHORN SHEEP LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RES. LIC. SALES	SHEEP HARVEST	PERCENT SUCCESS	NON. RES. LIC. SOLD	SHEEP HARVEST	PERCENT SUCCESS
1968-69	1,035	----	----	----	----	---
1969-70	1,061	56	.05	----	----	---
1970-71	989	58	.05	216	50	.23
1971-72	1,073	56	.05	199	43	.22
1972-73	1,008	73	.07	123	42	.34
1973-74	1,230	91	.07	107	35	.32
1974-75	935	92	.10	87	35	.40
1975-76	1,420	132	.09	70	42	.60
1976-77	1,753	132	.07	76	22	.29
1977-78	2,126	135	.06	67	38	.57
1978-79	2,422	134	.06	75	38	.51
1979-80	2,763	145	.05	75	41	.53
1980-81	2,480	193	.08	75	44	.59

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Elk

Elk or wapiti generally occupy the Rocky Mountain and foothill regions of Alberta with some sporadic occurences in forests in the central regions of the province. Estimated population is around 20,000 animals. Recent licence statistics are given in Table 5.

Moose

Moose inhabit most forest areas in Alberta and are particularly abundant in the north-eastern regions of the province. The estimated population of moose in Alberta is around 250,000 animals. Recent licence and harvest statistics are given in Table 6.

Overall Hunting Trends

Table 7 contains statistics on wildlife certificate sales in Alberta. Overall hunting pressure is increasing in the province. For some species such as moose, one season's harvest can be as much as 10% of the population. For other species such as grizzly bear, only a few animals are harvested annually yet the number of licences sold is increasing considerably. These licence and harvest trends are one component of the socioeconomic analysis of big game hunting. The past trends can help predict future hunting pressure and demands for the resource. The harvest rates and population sizes can help predict future resource supply relationships. These are the essential factors in the resource allocation problem, the supply and demand for wildlife resources. The next section outlines the manner in which an attempt is made to analyze and understand the problem of communication between the elements of the supply of and demand for wildlife resources.

B. Objectives of the Study

The overall objective of the study is to examine the components of the present system of allocation of the wildlife resources of the eastern slopes of the Rocky Mountains of Alberta from an economic viewpoint. The ultimate objective of the study is to present hypotheses about wildlife resource allocation and suggest measures that can be taken to more equitably and efficiently allocate resources. The next chapter presents the methodology involved with the allocation of wildlife resources. This section contains the

Table I.5: ALBERTA ELK LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RES. LIC. SOLD	ELK HARVEST	PERCENT SUCCESS	NON. RES. LIC. SOLD	ELK HARVEST	PERCENT SUCCESS
1968-69	26,181	4,395	.17	----	---	---
1969-70	27,449	3,623	.13	----	---	---
1970-71	25,192	----	----	349	----	---
1971-72	25,565	----	----	292	----	---
1972-73	18,095	2,156	.12	353	----	---
1973-74	18,869	2,104	.11	320	----	---
1974-75	15,775	1,600	.10	257	----	---
1975-76	16,191	1,506	.09	225	32	.14
1976-77	15,691	1,673	.11	250	36	.14
1977-78	----	----	----	----	----	---
1978-79	30,147	1,726	.06	248	28	.11
1979-80	32,378	1,204	.04	255	28	.11
1980-81	32,519	----	----	310	----	---

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Table I.6: ALBERTA MOOSE LICENSE SALES AND HARVEST STATISTICS, 1968-1981.

YEAR	RES. LIC. SOLD	MOOSE HARVEST	PERCENT SUCCESS	NON RES. LIC. SOLD	MOOSE HARVEST
1968-69	----	----	----	----	---
1969-70	49,616	17,713	.36	----	---
1970-71	49,578	----	----	4,024	---
1971-72	51,247	----	----	4,662	---
1972-73	40,554	----	----	4,107	---
1973-74	50,645	----	----	3,714	---
1974-75	40,082	6,775	.17	1,878	---
1975-76	40,635	8,095	.20	1,123	---
1976-77	42,797	8,828	.21	1,255	---
1977-78	----	----	----	----	---
1978-79	58,359	14,421	.25	1,188	---
1979-80	64,176	28,237	.44	1,306	---
1980-81	68,400	----	----	1,539	---

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

Table I.7: ALBERTA WILDLIFE CERTIFICATE SALES, 1968-1981

YEAR	WILDLIFE CERTIFICATES SOLD
1968-69	119,978
1969-70	117,408
1970-71	128,708
1971-72	132,451
1972-73	131,837
1973-74	132,421
1974-75	121,409
1975-76	124,804
1976-77	136,497
1977-78	---
1978-79	155,749
1979-80	161,117
1980-81	166,191

Source: Alberta Energy and Natural Resources Annual Reports, Resource Information Services, Alberta Energy and Natural Resources, Edmonton, Alberta.

elements (social, economic and institutional) that must be understood before any methods of resource allocation can be implemented.

II. Methodology

A. Introduction

Before inquiry can begin there must be a distinct need for the research, a need that is shown in the uncertainty and confusion that is present in the existing situation. In the situation surrounding the allocation of wildlife there exists a great deal of uncertainty. This section contains an examination of the issues that make up this indeterminate situation, determination of the roots and dimensions of the problem, a definition of the problem, and an indication of the direction inquiry should follow in order to derive hypotheses about the problem situation and its solution.

Before proceeding into the description of the disordered and uncertain elements involved in wildlife resource allocation, observation of a number of factors that are given or relatively constant within the situation is required.

1. A set of environmental conditions that provide wildlife habitat[4];
2. A set of biological conditions that when coupled with the environmental conditions determine the biological characteristics of the wildlife population;
3. A set of institutions that attempt to define property rights in wildlife;
4. Public agencies that are responsible for the management of wildlife resources;
5. A set of consumptive users of wildlife; and
6. Several sets of non-consumptive users who often conflict with consumptive users over the allocation of wildlife resources.

The first four of these factors essentially determine the supply of the resource while the latter two determine the demand for the resource. Assuming for the moment that the supply is fixed, an uncertain situation can be observed from the demand side alone. Consumptive user demands conflict with non-consumptive user demands. Those users exhibiting existence values (a willingness to pay to see a wildlife population maintained so that this particular species will not disappear) may also conflict with consumptive users and may conflict with certain other groups of nonconsumptive users as well. Those who possess option demand (the demand to be able to participate in either consumptive or nonconsumptive use in the future) can also be in conflict with both present consumptive users and other nonconsumptive users. Obviously, from the demand side alone, an indeterminate situation exists. Three areas are pointed out in particular, (1) the need for a more efficient distribution of wildlife resources between competing groups (or the determination of some efficiency criteria), (2) the need for an equitable distribution of these resources, and, (3) the need for a method of assuring the benefits of wildlife resources to future generations.

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[4] While it is true that wildlife habitat is one of the elements that often adds to the confusion, it is possible to determine the potential supply of wildlife as affected by environmental conditions.

While the demand for wildlife resources exhibits many of the uncertainties associated with the problem, the actual problem cannot be determined without consideration of the supply side. In terms of biological supply of game animals, there is considerable knowledge about numbers of wildlife species that can be supported by the eastern slopes ecosystem. There is little knowledge however about the long term effects of mans' influence on this habitat. Government agencies are not in direct control of the supply of wildlife resources. In some cases they may attempt to augment supply but, in general, public agencies are managers of the resource and they are only in charge of the distribution of the biologically provided resources. Institutions in the form of provincial legislation, reflect an attempt by society to define property rights in the wildlife resources. In other words, laws define who can hunt, how many animals can be harvested, where these animals can be hunted, when they can be hunted etc.. This artificial system of property rights is the mechanism by which provincial agencies control the supply of resources. Often this mechanism is ineffective.

The interaction between demand for and supply of wildlife resources should produce an optimum or equilibrium harvest of game animals and should indicate the amount of resources that should be allocated to game management and wildlife habitat. In fact, there is a lack of communication between the supply forces and the demand forces. It is this lack of communication that produces the market failure so well known to economists. The poorly defined property rights and lack of workable market institutions result in imperfect communication between supply forces and demand forces. This causes market failure, characterized by a lack of well defined prices and an inefficient allocation system. From the indeterminate situation we must proceed to the problematic situation, a situation where questions of the indeterminate situation are turned into facts or situations that provide some insight into the areas that must be explored to isolate the problem. An elaboration of the problems associated with the wildlife managment and utilization question is presented next.

B. Symptoms of the Problem

The symptom of the wildlife allocation problem that is most commonly presented is the declining numbers of wildlife species. At present the decline in the numbers of wildlife stocks is not as great as it was in the past. This slowing trend is due largely to measures taken during the past 100 years, including the imposition of hunting seasons, bag limits, restrictions on non-resident hunters, etc. These efforts constrain the demand for wildlife. Efforts have also been made to increase quantities of wildlife with projects such as winter feeding, game preserves, closed seasons, etc. Both of these institutional attempts to equate the supply of and demand for wildlife resources have positive social costs. While the possibility exists to substantially increase game stock there are also costs associated with this increase. There is not enough knowledge about the benefits to indicate whether or not the operation is "profitable" from a social standpoint. Nevertheless, the paucity of wildlife is a symptom of the wildlife management problem.

A second symptom of the problem is the conflict situation between consumptive users and all other user groups, including future generations. The demand for wildlife resources by consumptive users does not consider future availability of the resource nor does it consider the decrease in benefits of the non-consumptive user. Control of the breeding stock of the population of animals is not a concern of the consumptive user. The administrative agency must be responsible for the present and future supplies of game.

Overhunting is another symptom of the problem. Overhunting or depletion of game species results in a decrease in hunting quality and a decrease in the benefits of game animals now and in the future. Overhunting is the result of inadequate policing of the activity. The province manages the wildlife species for the people of Alberta. Within its management regulations is the ability to limit the number of hunters and the number of animals captured. The cost of enforcing such regulation throughout the vast area of the province is prohibitive however, and punishment for illegal hunting is almost always after the fact.

A fourth symptom of the problem is the conflict with nonresident hunters. Nonresidents of Alberta are allowed to hunt in the province but at substantially higher fees and with fewer freedoms than the resident hunter. The wildlife resources are owned by the residents of Alberta and so it would seem that Albertans should have priority in the use of these resources. On the other hand, nonresident hunters are a major source of income for the province's tourist industry and guiding and outfitting industry. If wildlife resources are not allocated to the nonresident hunter as well as the resident hunter, the outfitting industry will suffer. Also, if hunting quality declines, the guiding and outfitting industry will suffer. These questions depend on the accounting stance of the evaluating agency.

The question of the livelihood of the guiding and outfitting industry is an equity concern and not directly related to the efficient supply of and demand for wildlife resources. In order to consider equity issues in this analysis we must make value judgements about who should benefit from the resource. The incorporation of values into the process of inquiry does make the issue more difficult and complex but it does not make the analysis impossible.

A second equity issue concerns the rights of the non-consumptive users. Two distinct sets of values are apparent between consumptive users and conservationist groups. The latter group also has rights and interests that must be considered. Krutilla observed that we "need to recognize, and make provision for, the widest range of outdoor recreation tastes, just as a well functioning market would do."[5]

These value issues are often avoided by economists. However, in order to analyze correctly the question at hand, these issues must be incorporated into inquiry.

The symptoms of the wildlife resource allocation problem affect a wide variety of people. Hunters, wildlife photographers, campers and sightseers are all affected by the lack of well defined property rights and legal institutions in wildlife resources. Besides consumers of wildlife, the problem also affects guides, outfitters and others not directly involved in the capture of wildlife. Individuals who are opposed to consumptive use of wildlife are also affected, as are those who possess option demand or existence demand. Since wildlife populations face the possibility of irreversible depletion, the use of these resource by present generations dictates whether or not future generations will enjoy the benefits of these resources. Thus the allocation problem affects future generations and efforts must be taken to maintain some of the benefits of these resources for them.[6] Wildlife problems are of concern to a great number of people and while for some it is a minor concern, for others it may be a question of livelihood.

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[5] Krutilla, J.V. "Conservation Reconsidered", 57 *American Economic Review* (1967): 777-786.

C. Roots of the Problem

The major root of the problem is the property right situation. The province claims ownership of the wildlife resources but it does not actually possess them. When wild game is captured it becomes the property of the individual. When the animal is captured it essentially transforms from a public good (one which provides benefits to many users, especially nonconsumptive users) to a private good. The migratory nature of wildlife creates further problems in the definition of property rights. If game animals were kept on small restricted plots, control of the hunting of these animals would be relatively simple. Because game animals roam across vast areas, often across entire interjurisdictional boundaries, it becomes difficult to control ownership rights.

This lack of well defined property rights gives rise to another problem. The benefits of both consumptive and nonconsumptive users are not reflected in the amount they pay for the use of the resource. As long as rights to use, disposal and exchange are well defined, a market will arrive at a price for the good. Because the public agency has no direct control over the wildlife stock, hunters can refrain from stating their true willingness to pay for wildlife resources. While governments have attempted to simulate property rights in the form of licence fees and bag limits, these are often only token efforts. A minimal licence fee results in high demand for wildlife species. If extra market benefits were included, the demand would be much lower but the problem of property rights would not be solved.

Wildlife use by nonconsumptive users is a public good from which one cannot exclude others. Birdwatchers cannot exclude other sightseers from enjoying the benefits of a certain species. Because no consumer can be excluded, there is no incentive to reveal preferences for the activity. Thus there is no price or market for the activity.

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[6] If for no other reason, irreversibility should be avoided in order to increase the flexibility in the continuing development of society. See Ciriacy-Wantrup, S.V. *Resource Conservation: Economics and Policies* University of California Press, Berkeley. 1968.

The indefiniteness of the property rights in wildlife resources is caused by the biological nature of the resources and the existing institutional setting. This indefiniteness is accompanied by an imbalance of property rights. Wantrup defines property rights as imbalanced if they "lead to such a distribution of revenues and costs from resource utilization among members of a social group that the agent responsible for conservation decisions is not interested in taking all of the revenues and costs into account".[7] The provincial government derives the revenues from the sales of hunting licences but does not receive all of the benefits that hunters derive from the resource. The costs of conservation are entirely a provincial responsibility and neither funded directly by consumptive users nor by nonconsumptive users. The decisions to conserve must be made without realizing the true value to consumers. The demand for resources is determined without knowledge of the costs of production. This is the lack of communication between suppliers and demanders.

While the major root causes of the problem relate to the property rights issue, other factors also enter into the problem. Population growth has put pressure on wildlife resources not only in terms of the increasing number of hunters but also in terms of the demand for other resources (land, mineral resources, etc.) that affect wildlife habitat and populations. Urbanization has resulted in an increase in the numbers of nonconsumptive users. Technological change has also affected wildlife resource use through advanced hunting techniques and habitat encroachment by resource industries. Krutilla points out that as population grows and technology advances the relative value of wildlife resources increases compared to private goods.[8] Our economic institutions do not reflect this increase in value and thus it is not reflected in wildlife management decisions. As discussed earlier, the poorly defined property rights result in market failure and thus a lack of well defined values for the allocation of wildlife resources.

The roots of the problem point out the importance of property rights in the allocation of wildlife resources. In order to define the problem, we must yet evaluate the nature of the problem and decide how we may further analyze it.

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[7] Ciriacy-Wantrup, S.V. op cit

[8] Krutilla, J.V. op cit

D. Nature of the Problem

Northrup distinguished three types of problems: problems of logical consistency of theory, problems of the empirical truth of theory and problems of value. Each type of problem requires a different approach to solving the problem.[9] The situation at hand reflects all three types of problems. It is a problem of logical consistency since we do not truly understand the institutions and behavioral patterns involved in the use of wildlife resources. It is a problem of empirical truth since we do not have sufficient factual information about the demand for wildlife resources and the effects of management practices and legislation on wildlife resource use. The problem also involves questions of value since it addresses attitudes, beliefs, ethics, and equity issues.

A problem of logical consistency would be subjected to inquiry by "working out the consequences of a given set of assumptions".[10] Subjecting this problem to this type of inquiry may yield misleading results. Depending on the choice of assumptions the logical conclusions could vary greatly. Friedman has argued that if a theory is tested and the results are consistent with the empirical findings, then the truth value of the assumptions is not important, only the quality of the final theory is important.[11] Nagel[12] has argued that the truth value of a theory cannot be assured when it is based on a false assumption. Especially when dealing with such items as extra market benefit estimates, the assumptions must be as accurate as possible since there are no "real" values for comparison. As Randall points out "The results of other analyses, such as those that attempt to estimate that which cannot be observed (e.g., the prices of non-market goods) may never be directly testable against reality. In these cases, a major part of the important function of professional critiscism, to keep the analyst on the straight and narrow, involves examination of the assumptions used."[13] Although the inquiry cannot proceed using only logical progression, the point brought forth in this section is the importance of the validity of the assumptions.

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[9] Northrup, F.S.C., *The Logic of the Sciences and Humanities* The World Publishing Company, Cleveland. 1947.

[10] Hildreth, R.J. and E.N. Castle, "Identification of Problems", in *Methods for Land Economics Research* W.L. Gibson, R.J. Hildreth and G. Wunderlich eds. University of Nebraska Press, Lincoln. 1966. pp 20.

[11] Friedman, M. *Essays in Positive Economics* University of Chicago Press, Chicago. 1953. pp 7-16.

[12] Nagel, E. "Assumptions in Economic Theory", *American Economic Review*. 53 (1963):211-219.

[13] Randall, A. *Resource Economics: An Economic Approach to Natural Resource and Environmental Policy*. Grid Publishing Inc. Columbus Ohio. 1981.

The second path of inquiry is a matter of the empirical truth of theory. While considerable information is available on the biological aspects of wildlife resources, data are lacking in the areas of demand for resources and the interrelationships between supply factors and demand factors. Even though various management schemes have existed for years, little is known about the effects of these various schemes on resource demand. Also, Alberta has wildlife resource problems that are probably not common in other areas. These problems include native hunting issues, nonresident allocation of species such as grizzly bear and bighorn sheep and guiding and outfitting industry questions. These are also issues for which few data exist.

The final aspect of the problem involves a question of values. Normative questions of what "ought to be" are common in the wildlife management field. Nonresident hunters consider that they should be allowed more freedom than resident hunters since they are more experienced. Some resident hunters feel that off road vehicles should not be allowed in hunting areas. Nonconsumptive users feel that game animals should not be hunted. All of these are value questions. Observing facts alone will not solve a problem of value issues. Normative questions must be treated as a movement towards an optimum and not a single "best" solution. For inquiry to be effective, normative questions must be reduced to questions of fact. This process requires a form of analysis that can relate facts to normative issues.

The problem dealt with in this study has many facets and complications. A lack of logical consistency, a lack of empirical knowledge and a question of values are all reflected in the situation. While the problem still seems large and unwieldy, it can now be clearly defined. The definition of the problem must be stated such that a solution is possible and such that the direction of further research is revealed. The problem definition concludes the first stage of inquiry[14] and must lead to the inductive or empirical stage. Thus a problem must point out what facts are required.

Wildlife resource management depends primarily on social institutions and biological characteristics. Alteration of the biological characteristics is unlikely. Social institutions however are subject to change. In particular, property institutions and wildlife management institutions are the sources of difficulty in the allocation of wildlife resource. Considering all of the factors of this section, the problem at hand can be defined most clearly and concisely as follows:

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[14] Northrup, op cit. pp. 29

> *Prevailing wildlife management systems and economic institutions are inadequate to assure an efficient allocation of wildlife resources and an equitable distribution of wildlife among competing uses. The present allocation system utilizing licence fees and season limits is not an efficient distributional mechanism for the allocation of wildlife resources even among consumptive users alone. The prevailing economic institutions result in a poor preference revelation by the consuming group. This condition causes faulty communication between the administrators of regulations and demanders of the resource.*

The problem involves questions about the way wildlife policy relates to economic efficiency and equity issues. Are the present licencing systems adequate for the preservation of wildlife stocks for the future? Are the species who's populations are small in number being observed carefully to ensure survival? Can the guiding and outfitting industry continue to be a source of employment? These are just a few of the issues that will be considered in the analysis. The most important function of this study is to relate policy and economics within the present institutional framework.

The problem to be treated in this thesis involves considerable treatment of the economic and property institutions surrounding wildlife resources. A full institutional analysis is beyond the scope of this study. Rather, this analysis will explore the economics of wildlife resources from the demand side and relate the demand for wildlife resources to the policies that allocate wildlife resources. Communication between the demanders of the resource and the suppliers is the ultimate objective of wildlife resource analysis and it will be treated in part in this analysis

Some may consider the definition of the problem as an anticlimax after all of the arguments have been pointed out. Can one or two sentences lead inquiry to a point of solution? In order to point out the importance of next strict methodological procedures, the following section contains a review of a portion of the current literature in the wildlife resource area and the shortcomings of the analyses in solving the problem.

E. Current Problems in Wildlife Resource Theory

Most literature in wildlife resource allocation at least recognizes the property rights problem, but few authors concern themselves with the issue of social institutions and the alteration of property rights. The indefiniteness and imbalance of property rights problem has been divided into two major areas of research, one attempting to arrive at a "price" for the resource use and the other relating biological growth rates and harvest rates to optimal harvest efforts. These two catagories can be termed analysis of the demand situation and the supply situation respectively. In the first case, there is no revelation of preferences for the resource, so it is assumed that if a value is determined through empirical methods, this price will result in a more accurate communication between supply and demand. The supply analysis on the other hand involves bioeconomic modelling which observes species growth rates and determines the optimal harvest rate dependent on the price of the resource. A more specific analysis of present literature in these two catagories will now be presented.

Treating bioeconomic modelling first, this type of analysis has been applied primarily to fishery resources but some applications have also been made to game stocks. In general this method assumes free access to the resource as in the case of the open access fishery. These models generally assume that the price of the resource is known and the total revenue from the activity can be determined.[15] This assumption is not a valid one in the case of big game hunting since preferences are not revealed. One particular case of bioeconomic modelling does overcome the problem of price[16] but in this case the wildlife populations are held on private game preserves so a market does evolve, and property rights are fully specified. Bioeconomic modelling is also lacking in its efforts to solve a wildlife allocation problem since it can often provide rationale for the irreversible depletion of a species if the interest rate chosen is high enough. The value question of equitable wildlife distributions over generations is sidestepped.

The analysis of the wildlife allocation problem from the supply side is inadequate since prices and perfect markets do not exist. The analysis of the demand for wildlife however is attemping to place a price on resource use and thereby equate supply and demand. Dwyer, Kelly and Bowes provide a general outline of the methods for evaluating extra-market benefits that accrue to both consumptive and nonconsumptive wildlife users.[17] While these methods of extra market benefit calculation are fairly convincing the determination of this value alone does not solve the allocation problem.[18] Even if licence fees are imposed at the rate of average extra-market benefit, none of the equity issues will be solved and the property rights will still remain attenuated. The lack of well defined property rights result in the absence of the price. Determining the approximate price through statistical methods is useful as a measure of value but it does not strengthen the property rights. Wildlife would still not be traded in a controlled market, and all of the symptoms mentioned earlier would still exist.

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[15] Clark, C.W. *Mathematical Bioeconomics: The Optimal Management of Renewable Resources* John Wiley and Sons, New York. 1976.

[16] Beddington, J.R., C.M.K. Watts and W.D.C. Wright, "Optimal Cropping of Self-Reproducible Natural Resources", *Econometrica* 43 (July 1975): 789-802.

Some authors have suggested that the price system be used to help allocate wildlife. Peters[19] suggests that raising the price of licence fees sustantially would decrease the consumption of wildlife and thus save more game animals for the future and provide additional revenues for intensive game managment. The social and economic institutions of our society would likely not allow such a proposal to become reality. Raising licence fees would add to the equity problems as lower income hunters would be excluded. Proposals to establish a market in wildlife resources by establishing a price are not tenable since the property institutions must exist before the market can be established. Undoubtedly Peters' solution would result in an increased amount of poaching and the additional management revenues would have to be devoted to additional policing of hunting activities.

Research in wildlife economics has strayed from the path of solving the problem and has concentrated on solving the symptoms of the problem. The fact that no price exists and game stocks are dwindling are only symptoms and a solution to these problems cannot be determined without treating the property rights question. Just as public goods theory has been suggested to have a "misplaced emphasis" on revealing preferences[20] wildlife allocation theory has a misplaced emphasis on determining extra market benefits. More attention must be paid to property institutions.The next section contains such examples from the current literature.

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[17] Dwyer, J.F., J.R. Kelly and M.D. Bowes. *Improved Procedures for the Valuation of the Contribution of Recreation to National Economic Development* Water Resorces Center Report #128. University of Illinois, Urbana-Champaign. 1977.

[18] Discussion of the various techniques involved in the calculation of extra market benefits will be discussed in the next chapter.

[19] Peters, J.E. *Wildlife Management: Adequacy of and Problems in Regulation* Economic Coucil of Canada Working Paper #27. Ottawa 1982.

[20] Johansen, L. "The Theory of Public Goods: A Misplaced Emphasis", *Journal of Public Economics* 7 (1977): 147-152.

The discussion to this point has revealed that property rights are the most important element in the wildlife allocation issue. What are property rights and how can they be used in the allocation process? Wantrup defines property as a bundle of rights to control.[21] The individual strands of this bundle can be distributed among various groups including government, the owners, creditors, etc.. This definition of property does little to clear up the understanding of the wildlife issue but the link between property rights and other social institutions may help. Social institutions are composed of the habits, mores, ethics and practices of a society. These institutions are the underpinnings of property. Changes in social institutions can affect property rights. Demsetz utilizes this concept of property in his definition of the concept:

> Property rights are an instrument of society and derive their significance from the fact that they help a man form those expectations which he can reasonably hold in his dealings with others. These expectations find expression in the laws, customs and mores of a society. An owner of property rights possesses the consent of fellowmen to allow him to act in particular ways.[22]

The social institutions are strongly tied to the property institutions. In particular, if a society decides that an uncompensated externality is occuring, social institutions will reflect this feeling and property institutions will begin to change in response to public sentiment. Demsetz provides an example that will clear up any confusion in this area. The particular case is the development of property rights in land resources at the turn of the century. This case outlines the relationship between property rights in land resources and the price and trade of furs. In particular, the Indians of the Labrador penninsula were found to have a well structured set of property rights well before other Indian groups (in the southwest U.S.) Before the fur trade began, hunting was primarily for food and clothing and game was abundant enough that social costs were not imposed on anyone. Once the fur trade began hunting activity increased but it was in no person's interest to replace game stocks. The harmful effects were evaluated by the society and the social institutions began to change. As Demsetz states "it reveals clearly the role played by property right adjustments in taking account of what economists have often cited as an example of an externality the overhunting of game.[23]" The Indians of this region began to mark off the hunting grounds for that family and its future generations.

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[21] Ciriacy-Wantrup, op cit pp. 140-141

[22] Demsetz, H. "Toward a Theory of Property Rights", *American Economic Review* 57 (May 1967): 347-359.

While the Indians of the Montagnes region established property rights, other Indian groups that experienced the same rise in fur demand did not. Property institutions did not develop along the same lines because the costs associated with these institutions were too high. In the southwest for example, game animals were primarily grazing species that migrated over vast areas. The social costs of internalizing this type of hunting externlaity were too great for the institution to develop. In the Labrador region however, it was feasible to establish property institutions. Two important points can be made about this analysis of Indian hunting. Firstly, property rights are defined by social institutions and public values. Secondly, social institutions only change when the perceived cost of the externality is greater than the benefits of the new situation or when property rights and values of a society dictate change.

This type of institutional change has been apparent in the wildlife resource field for decades. James Tober provides valuable insights into the development of property institutions in wildlife resources and points out rather clearly that there were explicit reasons for the maintenence of "indefinite" or "imbalanced" property rights.[24] In fact, most wildlife resource economists would likely be surprised to find out that property rights in wildlife were more clearly defined in some regions of the U.S. in the past than they are at present. Hunting clubs began to establish property rights in wildlife that were tied to the land. Nearly 800,000 acres of privately owned land reserved for shooting clubs existed at the turn of the century. These private clubs were abolished in the early 1900s by a change in social institutions that considered equal access to the resource as a most important criteria. Public policy since that time has reflected this sentiment.

The influence of social institutions has not been adequately understood in wildlife resource economics. Current literature either analyzes supply models that reflect no institutional concepts or develops demand models that attempt to create perfect markets in an area where institutions preclude these type of controlled markets. In order to understand wildlife resource allocation the institutions behind the present allocation system must be understood. Simulated market solutions may reflect higher costs than the present situation.[25]

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[23] Demsetz, H. *op cit* pp 351.
[24] Tober, J.A. *Who Owns the Wildlife?* Greenwood Press, Westport Conn. 1981.

While institutions are the most critical factor in the allocation of wildlife resources, they are also the best mechanism for altering resource use. Social institutions are subject to change. As Wantrup points out, "Even though formulation and execution of conservation policies are affected by social institutions, such policies can still aim at changing the influence of social institutions upon the state of conservation."[26] In particular Wantrup points out several "direct" and "indirect" policies that can move toward the optimum state of conservation. This must then be the direction of research in the wildlife management field; to analyze the factors involved with the demand and supply of game animals and the property and institutional framework and determine how policy can achieve the desired objective of efficient and equitable allocation of wildlife. While property institutions and other social institutions do not change quickly, an analysis of the factors that affect hunting within the present institutional framework will provide insight for policy prescriptions. The majority of this thesis will analyze economic factors associated with hunting activity and relate them to wildlife resource policy. The underlying institutions, while being of too large a scope to analyze in this study, obviously are the underpinnings for the economic and policy considerations. The next section contains an explanation of the inductive phase of analysis and how facts are obtained to help explain the wildlife allocation situation.

F. Inductive Analysis of Relevant Facts

The objective of the second stage of inquiry is to acquire knowledge about the problem situation in the form of facts. This inductive analysis combines with the deductive analysis to form hypotheses about the situation. The main objective of this second stage is to indicate data requirments for hypotheses formulation.

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[25] See Wilson J.A., "The Economical Management of Multispecies Fisheries", *Land Economics* 58 (November 1982): 417-434

[26] Ciriacy-Wantrup, op cit pp 228.

Factual information is needed about the supply of wildlife resources. Information is needed about the institutions that define property rights and determine the structures and procedures of wildlife management. Facts are needed about the objectives and activities of public agencies involved in wildlife management. These facts can be obtained relatively easily. Biological estimates of potential carrying capacity are available for most regions of the province. Facts about present institutions are available from legal statutes and regulations. Objectives of public agencies are published periodically.[27]

Economic and social data about wildlife users are not as easily obtainable. Detailed information is needed about characteristics that affect the demand for wildlife. Factual information is needed to construct a model of wildlife demand. The sentiments and attitudes of users of wildlife are also necessary and are likely the most difficult form of data to acquire.

Observation of facts and the description of facts are two entirely different procedures. While collection of facts about consumptive users of wildlife is possible these facts cannot be understood until they have been described. Responses to questions about incomes, expenditures and similar items may be biased for any number of reasons. Facts that are suspect must be described with the cautions included. In particular, hypothetical questions about wants and values must be used very carefully in developing hypotheses.

Described facts are still not adequate for hypothesis formulation. Facts must be classified and analyzed. When all of the relevant facts have been observed, described, classified and analyzed, the inductive phase of research is complete. These facts will be used in conjunction with the deductive phase of research to develop hypotheses.

G. Designing and Testing Hypotheses

A hypothsis is constructed from both the deductive and inductive phases of research. Hypotheses cannot be determined from deductive knowledge alone as no new knowledge would ever result. The concepts, principles and historical theories of the deductive stage are brought together with the inductive results to make observations about the situation at hand. As an example, present models of hunting demand included in the deductive stage would be applied to the analysis phase of inductive research to form a hypothesis about hunting demand for the data set being examined. The first two stages of research combine to design hypotheses.

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[27] Recently the Alberta Fish and Wildlife Division has published such an objectives statement

Good hypotheses display several desirable attributes including testability, clarity, adequacy of scope and depth and simplicity.[23] The most critical attribute of a hypothesis is testability. In order for a hypothesis to be fully testable, one should be able to deduce consequences which can be checked against fact and reason.

The methodological processes that will lead to the solution of the problem of wildlife allocation have been presented. The major points can now be summarized. Firstly, a proper analysis of the problem reveals that property rights and social institutions are the major sources of difficulty in the allocation of wildlife resources among users. Secondly, present research in wildlife economics has not treated the problem but only the symptoms of the problem. Thirdly, the path pointed out by the methodological analysis is to analyze deductively the situation and then collect empirical facts about wildlife supply, demand and institutions. Fourthly, the empirical analysis and deductive analysis should be combined to develop hypotheses about the solution to the problem. The next chapter begins this procedure by reviewing current theories of resource allocation with special reference to the wildlife situation.

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[23] Larrabee, H.A. *Reliable Knowledge* Houghton Mifflin Company, Boston. 1964. pp 148-152.

III. Theoretical Synthesis

The wildlife resources of the eastern slopes of Alberta's Rocky Mountains provide benefits to various groups of users year round. The lack of well defined property rights precludes the functioning of a normal market in this area. This section outlines the economic rationale for the allocation of big game wildlife animals. Much of the discussion centers around the techniques of simulating markets in the distribution of wildlife resources. This topic, however, is only one of the many aspects that must be considered when analyzing the resource base. The first section of this chapter contains a discussion of resource classification and various definitions involved in the resource allocation issue. Methods of determining the economic value of wildlife resources is discussed in the second section. A more general model of wildlife allocation theory is presented in this section. The role of these economic values in overall problem analysis is the topic of the third section. In general, this chapter moves from a broad orientation of wildlife resource allocation policy to a more specific statement of how economics can aid in the determination of wildlife policy.

A. The State of Conservation

The ultimate goal of wildlife policy is to maximize the social net benefits to society over time while still maintaining the resource base at a healthy and viable level. Wantrup[29] calls this the "optimum state of conservation". Many consider conservation to mean the non–use of resources or use at a constant rate. Conservation is actually the timing of resource use. If more of the resource is left for future consumption, conservation is acheived. If more of the resource is used in the present,depletion exists. Conservation and depletion are defined in terms of "changes in the intertemporal distribution of physical rates of use".[30] In order to determine an optimum state of conservation or an optimum distribution of use rates over time, some weighting scheme must be employed to weigh the benefits of the resource now and in the future. While this weighting scheme may be some form of discount rate its actual formulation may be difficult due to factors such as uncertainty, risk , etc.. Thus the quantitative determination of an optimum state of conservation may be difficult but a quantitative analysis of the wildlife resource sector may provide some insight as to which direction (toward conservation or depletion) society should move.

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[29] op cit pp. 380.
[30] Wantrup, *op. cit. pp 51.*

There are many issues which must be considered in the analysis of physical use rates over time. Firstly, present users of a resource, if they consume resources to the extent that potential future consumption is decreased, are placing costs on future generations. The costs imposed on future generations by the present generation (called user costs by some resource economists) should be considered in the intertemporal allocation of resources. Consideration of user costs would result in decreased demand (due to the higher price of the resource) if use rates impinged on future consumption. The allocation of resources over time also depends on time preference. Individuals may desire to consume resources immediately but, when social time preference is considered, resource conservation may be the goal. These two time preferences are different and resource policy makers must consider that social goals may conflict with private goals. This conflict is particularly important when considering the public goods nature of wildlife resources. Wildlife resources are a form public good in the sense that they can be enjoyed by many sightseers, hikers, and others without loss of benefits to any individual from the addition of another nonconsumptive consumer. The addition of a consumptive consumer (e.g., hunter) however, will reduce the others' benefits to zero. Intertemporal allocation of wildlife resources becomes even more difficult when the private and public good nature of the resource is considered. Both the private and social time preferences of each type of consumer must be considered.

Beyond the difficulties in intertemporal allocation, public goods aspects associated with wildlife resources complicate resource allocation decisions even further. The notion of scarcity rents implies that the scarcest resources (those resources that have high demands but are in short supply) have the highest value. Scarcity of the resource results in a rent that raises its price, and in the case of renewable resources, keeps this price or value high until the level of scarcity of the resource decreases. Due to the public goods nature of wildlife resources (the poorly defined property rights) values are not presented in a market and scarcity rents do not function as they would in a normal market. All of these complications make conservation decisions complex and multifaceted and caution must be used even in the definition of these concepts.

In the past few years the concepts of conservation and depletion have taken on meanings that are slightly different than presented here. Conservation has taken on the connotation of non-use and depletion has a connotation somewhat similar to exhaustion. Also the emergence of the concept of sustained yield has caused vast misunderstandings of the resource allocation problem. Sustained yield has become a panacea for all resource problems when in fact it is not likely a desirable economic policy objective. Maximum sustained yield can only be employed when the demand for the resource dictates such a level. If there is no demand for the resource, use at such a rate would be wasteful. Maximum sustained yield has many other detrimental qualities. Wantrup states that maximum sustained use is a meaningful economic objective only when the stock can be removed without affecting the natural flow, when it is not economical to increase the stock available and when costs and prices are such that it is not economical to remove an amount other than the sustained yield amount. All three of these conditions must hold. [31]

Clark provided several other limitations of the sustained yield concept.[32] In particular, sustained yield is often a biologically ambiguous concept especially when interdependent species are involved. Many resource stocks fluctuate rapidly and sustained yield estimates are not possible. Clark also shows that the economic concept of sustained yield is not appropriate as an allocation rule since it acknowledges the benefit side (or revenue side) of analysis only and does not consider the costs of the operation. If the costs become prohibitive in relation to the benefits of the resource, sustained yield is not economically desirable. Clark states "... it is extremely unlikely that in any particular case a maximum sustained yield harvest policy will prove to be optimal in an economic sense."[33]

Sustained yield is not an appropriate criteria to follow in renewable resource allocation. The determination of a more desirable resource allocation mechanism however requires that the characteristics of the resource be defined more clearly. Wildlife resources fall into the catagory of "renewable resources."[34] This flow may increase or decrease at a constant or varying rate dependent on the characteristics of the individual species. Within the renewable resource catagory are two subgroups, those renewable resources that are significantly affected by human action and those that are not. Wildlife resource fall into the first subgroup. Within this subgroup are two more catagories, those resources that possess a critical zone and those that do not. A critical zone is a region or point beyond which flow decreases cannot be reversed under present economic conditions. This zone of irreversibility applies to wildlife resources and has also been referred to as "critical depensation" by fisheries biologists and some renewable resource economists. Since the possibility of irreversibility exists, care must be taken not to encroach on this zone. As Krutilla said, this aspect of irreversibility is "unlike resource allocation questions dealt with in conventional economic problems".[35]. While the maintenence of the species population above critical zone levels would seem to be a fairly simple management objective, the critical zone is often an elusive concept. Irreversibility is defined in economic terms and not technological terms. While the possibility exists to maintain a species with only a handful of members remaining, it may not be economically beneficial to do so. The zone of irreversibility fluctuates with social values, institutions, and the state of technology. Several example of open access fisheries exist where a resource has been exploited beyond the critical zone. While in some of these cases the level of the critical zone was not determined, levels of critical zones in other cases were well known and still resource exploitation occurred[36].

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[31] op cit pp 60

[32] Clark, C. W. *Mathematical Bioeconomics: The Optimal Management of Renewable Resources* John Wiley and Sons, New York. 1976.

[33] Clark, op cit pp. 2.

[34] Wantrup, op cit pp. 42

The classification of wildlife resources reveals the fundamental rule of renewable resource allocation; the critical zone must be avoided. This concept is the Safe Minimum Standard of Conservation.[37] The first rule of renewable resource allocation is to avoid the critical zone since irreversible losses in the present period would preclude benefits in future periods and thus the optimum state of conservation could not be acheived. Since the optimum state of conservation depends on the value of use rates over time, the elimination of future use rates cannot be justified unless the benefits of such depletion are extreme. Even if these benefits are extreme (i.e., the social discount rate is very high) there still exists uncertainty about the flow of benefits and costs in the future. We cannot develop a rationale for the irreversible depletion of a resource without complete knowledge about future conditions and preferences. Wildlife population dynamics cannot be predicted with complete certainty. This uncertainty (as well as uncertainty about demand trends) is one argument for the safe minimum standard on efficiency grounds since benefits will not appear in the future and therefore not be maximized. An equity argument also exists. In order to preserve intergenerational equity (equity from one generation to the next) resources must be preserved for future generations. The present generation can determine the flow of resources into the future but the future generations will not have a choice about the variety and quality of the resource they receive. Thus in order to achieve intergenerational equity the safe minimum standard must be followed. In most economic analysis the efficiency and equity concerns proceed in opposite directions. This situation is one case where both concerns point to the same result.

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[35] Krutilla, *op cit.*
[36] See Clark, op cit
[37] Wantrup, *op. cit.* pp 251.

The optimum state of conservation and the safe minimum standard, are two concepts that are the basis for wildlife resource allocation. They are however, still very broad objectives. The task now becomes one of narrowing the range of policies that incorporate the safe minimum standard and utilize the optimum state of conservation theory. In other words the task now is to "fine tune" resource allocation theory.

B. The Economic Value of Big Game Animals

Big game animals possess value in four different ways. They are valuable to those who wish to hunt them (consumptive value), they are valuable to those who wish to observe and photograph them (nonconsumptive value), they are valuable to those who wish to have the option to participate in these activities in the future (option value), and they are valuable to those who are willing to pay for the maintained existence of the species (existence value). These four sources of value are the primary elements in the economic analysis of wildlife resources. In a perfect market, the various values would dictate how much of the resource would be allocated to each activity depending on the willingness to pay of each group of participants. Because there exists a structure of imperfect and imbalanced property rights, however, this market action does not take place. Instead, the allocation of wildlife resources has become an institutional activity with legislation determining the levels of resource use. This institutional system, although it has evolved over many years and has made vast improvements in many areas of wildlife allocation, is still not the perfect system. The more accurately the estimates are for the value of wildlife, the more we can begin to understand the demand for wildlife resources. An ultimate understanding of the demand for wildlife resources is a key in the solution of the problem described in the last chapter.

C. The Measurement of Extramarket Values

Three methods of determining extramarket value are in common use today. Each of these techniques attempts to reveal preferences for wildlife resource use or the activity related to the resource. The techniques are: the direct technique, the travel cost approach and the hedonic price technique. A fourth method of analysis in this area that is not in common use is also discussed in this section, the household production function technique. Each of these methods not only attempts to value a unit of the recreation activity but more importantly attempts to explain the demand for the activity through a theoretical model.

The Direct Method

The direct method is based on the assumptions that the individual is able to place a value on the activity in question and that this value can be elicited through a survey question or bidding game. An example of a survey question is "What would you be willing to pay, over and above all other costs, for a day of hunting in Alberta." The values determined through this question are then subjected to regression analysis to derive a demand curve. Some of the more common formulations include the following;

Willingness to Pay = f(Income, Experience, Length of Stay)

Willingness to Pay = f(Income, Experience, Expenses, Bag Rate, Days)

The first equation was used by R.K. Davis[38] in one of the earlier efforts in this area and the second form was used by Hammack and Brown.[39] Several other studies have used this type of analysis and have provided some confidence for the application of the technique.[40]

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[38] Davis, R.K. "The Value of Big Game Hunting in a Private Forest", in *29th North American Wildlife and Natural Resource Conference.* (1963): 393-403.

[39] Hammack, J. and G.M. Brown. *Waterfowl and Wetlands: Towards Bioeconomic Analysis* Baltimore. Resource for the Future Press. 1974.

The accuracy of the direct approach depends very greatly on the type of question used and the survey method. Some have suggested that the willingness to pay revealed through the direct technique will differ from the willingness to pay revealed when actual dollars are used.[41] A second problem in the direct approach is the question of willingness to pay values versus willingness to accept compensation values. The second type of question is worded such that the consumer reveals the amount that he must be paid in order to give up the activity. In theory these two measures should be similar since the compensating and equivalent variations should be similar but in actual empirical estimates the willingness to accept compensation is higher than the willingness to pay.[42] Some authors have attempted to explain this discrepancy through the influence of income effects and free rider effects but no clear explanation has yet been achieved. One simple explanation may be as follows. The willingness to pay value is computed on a daily basis while the willingness to accept compensation is usually computed on a seasonal basis. In this case the willingness to accept compensation (WTAC) measure is actually the area under the demand curve while the willingness to pay is the "price" of the activity. Thus the first derivative of the WTAC should yield WTP and WTAC will always be greater than WTP. This is one area where further analysis is required.

The direct technique is easily administered and can be used without incorporating too many limiting assumptions. Also the questions can be altered to attempt to reveal consumptive as well as nonconsumptive, option and existence values. This technique need not be site specific and can seperate out a wildlife component from the overall activity.

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[40] See Langford, W.A. and D.J. Cocheba. *The Wildlife Valuation Problem: A Critical Review of Economic Approaches*. Canadian Wildlife Services Occasional Paper #37. 1978, and Dwyer, J.F., Kelly, J.R. and M.D. Bowes. *Improved Procedures for the Valuation of the Contribution of Recreation to National Economic Development*. Water Resources Center Report #128. University of Illinois, Urbana Champign. 1977>

[41] Bishop, R.C. and T. Heberlien, "Measuring Values of Extramarket Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics* 61(December, 1979): 926-930

[42] This stems from the assumption that the two values are in fact proxies for compensating and equivalent variation. See Gordon, I.M. and J.L. Knetsch. "Consumer Surplus Measures and the Evaluation of Resources", *Land Economics* 65 (February 1979): 1-10.

Travel Cost Model

The travel cost model has been the most widely used form of extramarket benefit estimation. The technique has undergone many refinements and improvements yet many are skeptical about its accuracy and usefulness. A good summary of the development of the travel cost model and its assumptions can be found in Dwyer, Kelly and Bowes.[43]

In its basic form the travel cost model utilizes the travel cost component of the activity as the price variable and determines the relationship between travel costs and days of the activity. This relationship between days and travel costs forms the basis for a demand schedule which is then utilized to derive extramarket values. The area under the demand curve is the willingness to pay for the activity in terms of the travel costs. The area of the consumer's surplus (that area under the demand curve above equilibrium price) is the extramarket benefit.

The travel cost model has many restricting assumptions. Firstly, it deals with site specific analysis. Secondly, it assumes that the consumer would view entry fees as similar to additional travel costs. Thirdly, the travel cost model assumes that there are no benefits derived from travel to and from the recreation area and, finally, the travel cost model is of little use when considering a mobile resource as we are in this study. Some interesting formulations of the travel cost model have sparked discussion about time costs and congestion costs and their effects on recreation values yet there are no appropriate formulations of the travel cost model that account for these values.

Hedonic Price Model

The hedonic price method of determining extra-market benefits has its roots in household production theory. In this approach utility is maximized by the production of goods from various inputs. In the case of hunting for example, a unit of the activity hunting would be produced from "inputs" of market goods purchased, time spent in the activity, distance travelled, etc.. Instead of maximizing utility from the purchase of goods as in the traditional approach to consumer theory, the consumer in this model actually produces the goods first and then maximizes utility.

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[43] Dwyer, Kelly and Bowes, op cit

Consider a consumer who maximizes utility from hunting (H) and all other goods (S), subject to a normal income constraint:

$$U = U(H, S)$$

In household production theory the "dual" activity is observed first as the consumer produces the good called hunting:

$$H = f(X_1, X_2, \ldots\ldots X_n)$$

Hunting is produced from various inputs (X's) which include the time spent hunting, expenditures on hunting equipment, travel costs, etc.. In this model the consumer actually maximizes utility while minimizing the costs of inputs in the production function. The consumer solves for the demand for the recreation activity while simultaneously solving for the supply of inputs into the production of the activity.[44]

These basic elements are the household production theory as developed by Lancaster and Becker.[45] The development of this form of utility maximization has led to the "Hedonic Price Model" in which a hedonic price function is estimated to be the locus of points that make up the intersection between the inputs and outputs of the model. In other words, the hedonic price function is the locus of points that join the least cost production decisions of the consumer with the maximization of utility decisions.

The hedonic price function takes the following form:

$$\text{Expen} = f(\text{Days, Harvest, ...})$$

where Expen is the total expenditure on the activity and the independent variables are the inputs used in the production of the activity. The "implicit price" of each input can be determined by differentiating the function with respect to each input:

$$\partial\ \text{Expen}/\ \ \partial\ \text{Days} = \text{Price of Days}$$

$$\partial\ \text{Expen}/\ \ \partial\ \text{Harvest} = \text{Price of Harvest}$$

These implicit prices can then be used in a demand function for the activity as follows:

$$\text{Days} = f(\text{Price of Days, Price of Harvest, Income, Experience})$$

The hedonic price function must be non-linear since linear hedonic price functions would yield constant implicit prices and a demand curve could not be identified.[46]

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[44] See Rosen, S. "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition", *Journal of Political Economy* 82 (January 1974): 34-55.

[45] Lancaster, K. "A New Approach to Consumer Theory", *Journal of Political Economy*. 74 (April 1966): 132-157. Becker, G. S. "A Theory of the Allocation of Time" *Economic Journal* 75 (1965):439-517.

[46] See Freeman, A.M. *The Benefits of Environmental Improvement*, Baltimore, John

Secondly, the utility function must be weakly separable between hunting and non-hunting sectors. Thirdly, in order to construct a demand curve of the form above, the supply of the inputs must be perfectly elastic. The value of time must also be assumed neutral among all household production activities.[47] All of these assumptions are limiting, especially the question of the value of time. Nevertheless, the hedonic price method is a more general form of analysis than the travel cost function. The hedonic price method can be simplified to yield a travel cost model but in its complete form it represents a more comprehensive approach to benefit estimation.

Household Production Function Approach

The final method of estimating the value of wildlife recreation is the household production function approach. This technique is relatively new to the field and while the it is the basis for hedonic price estimates, the basic theory has not been well extended into the wildlife resource area. This section outlines the applicability of the household production function theory to the modelling of the wildlife resource area. The hedonic price technique summarizes the extra-market benefit estimation procedure that stems from this technique but a more general analysis of household production theory will provide some more interesting methods of analysis, namely shadow prices and the value of time, and congestion in the recreation activity.[48]

The basic model for hunting activity can be formulated as follows. Utility is a function of hunting (H) and a composite commodity of all other goods (S):

$$U = U(H, S)$$

Hunting and the composite commodity are characteristics that are produced from the market purchase of goods and the use of the individual's time. The time budget can be written as;

$$T = Th + Tm + Ts$$

where T is the total time available, Tm is the time spent in the market earning wages, Th is

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[46](cont'd)Hopkins University Press, 1979.

[47]See Pollack, R. and M. Wachter. "The Relevance of the Household Production Function and its Implications for the Allocation of Time." *Journal of Political Economy.* Journal of Political Economy. 83 (April 1975): 255-277.

[48] Much of this section is adapted from Banskota, K, W.L. Adamowicz and W.E. Phillips, "Recreation Activities, Congestion and the Opportunity Cost of Time: A Household Production Function Approach", Unpublished Paper, Department of Rural Economy, University of Alberta, Edmonton.

the time spent hunting and Ts is the time spent engaged in other activities. This time budget can be incorporated into the production of the characteristics. The characteristic hunting for example is produced from time, market purchases and distance travelled:

$$H = H(Th, Xh, D)$$

As in the hedonic price specification there cannot be jointness in the production of hunting and the other services. Utilizing the utility function and the production function we can develop the tools necessary to analyze the model; the full income constraint and the shadow prices. The full income constraint is formulated as:

$$I=Y+TW = H(ThW + PhXh + PdD) + S(TsW + PsXs)$$

This full income constraint equates the labour income (TW) or the time spent in the market times the wage rate plus non-labour income (Y) with the expenditures on hunting and the composite good plus the opportunity cost of time spent in these activities. The expenditures on hunting include the market purchases (PhXh = the price of market purchases times the quantity of market purchases) and the travel cost (PdD = the price per kilometer times the kilometers). The opportunity cost of time spent in the activity is determined by multiplying the wage rate (the real opportunity cost of time) times the time spent hunting. The expenditures on the other goods are calculated by multiplying the price of the goods times the quantity purchased (PsXs) and the cost of time in these activities is determined by multiplying the wage rate times the hours spent in these activities (TsW). These components all make up the budget constraint in which the amount the consumer can spend on hunting is limited by the labour and non-labour income and the hours that he spends in each activity.[49]

Maximizing the utility function subject to the income constraint can be performed using the Lagrange technique as follows:

$$\text{MAX } U = U(H, S)$$

$$\text{Subject to } I = H(ThW + PhXh + PdD) + S(TsW + PsXs)$$

This yields the lagrange function;

$$L = (H,S) - \lambda \;[\, H(ThW + PhXh + PdD) + S(TsW + PsXs)]$$

The maximization leaves us with the shadow prices of hunting activity as;

$$\text{Shadow Price} = ThW + PhXh + PdD$$

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[49] See Becker, op cit for a more comprehensive description of the full income constraint.

The shadow price is the real value of the activity as it incorporates all of the costs incurred in the activity including the opportunity cost of time. While this particular shadow price is crude, the utility maximization framework can be adapted to incorporate many more complex items. As it stands, however, the household production technique leaves us with something that is not apparent in the other three methods of analysis, a general view of the recreation system. Now that the basic model has been reviewed we can turn to making the model more realistic by including varying measures of the opportunity cost of time, accounting for costs of congestion and finally incorporating supply side effects into the model.

The household production function approach to the wildlife resource allocation question presented here is not an empirical technique that attempts to reveal preferences. It is a theoretical framework which leads to the development of components of demand for consumptive recreation activity. In this aspect, it does not propose a clear-cut technique to determine values. Rather, it can cater to the particular problems associated with the resource. If the problem of congestion is a pertinent question in the recreation activity, the model can be redefined to incorporate congestion as an effect on utility and value. Reformulating the production function for hunting activity, we can propose that congestion will decrease utility dependent on the number of encounters in the hunting area (n) and the sensitivity of the activity to encroachment by other participants α. If the activity is one in which the hunter must be free of disturbances in order to obtain utility (mountain goat hunting for example), the α would take on a relatively large value. The larger the value of α the greater the disutility from congestion. As well, if the number of people in the area rises utility will also decrease. These effects are likely to compound each other. Thus the relation between the level of utility from hunting without congestion (H) and the utility from hunting after congestion (H^0) can be expressed as:

$$H^0 = \alpha^{-n} H$$

If there are no other hunters at the site the value of n equals zero and the sensitivity factor has no role to play. This relation between the congestion factors and the level of hunting can be expanded and incorporated into the production function for the activity as:

$$H = \alpha^{n} H^0 (ThW + PhXh + PdD)$$

Now the level of congestion affects the production of the activity and becomes incorporated into the shadow price since the production function becomes part of the full income constraint. The new shadow price becomes;

$$\textbf{Shadow Price} = \alpha^{n}\ (ThW + PhXh + PdD)$$

As congestion increases, the shadow price of hunting activity increases. A unit of uncongested hunting becomes more expensive from the individual's point of view.

The incorporation of the congestion factors into the model is not meant to be a strict formulation of the quantification of congestion values; rather it is to point out the flexibility of the model in incorporating congestion effects into the analysis of values, shadow prices, and demands for recreational hunting. The cost of congestion has been a point of contention among economists recently. Travel cost models have not been formulated to accurately take congestion into account although some techniques have been attempted. Hedonic price models have not yet been subjected to questions of congestion. The household production model shown here may lead to a better understanding of the disutility associated with congestion and it may lead to a better system of quatification. While the modelling of congestion effects in household production models is relatively straight forward, the value of time spent in the activity is not as easy to account for. Recalling the assumptions of the household production function model, time must be valued equally at the wage rate in order not to violate the non-jointness in production rule. In actuality time is likely valued very differently depending on the activity. Some activities may be valued at rates lower than the wage rate while others may be so enjoyable to the consumer that he values them more than labour hours. While in the theoretical model it is not possible to allow for such differences in the opportunity cost of time, it is possible in empirical analysis to value time differently.

The shadow prices constructed in the household production model are made up of three parts, the market purchases, travel costs and the opportunity cost of time. In a strict theoretical model, the opportunity cost of time must be valued at the wage rate. Traditional economic analysis assumes that leisure values are likely lower than wage rates but this may not be the case. Leisure values are extra-market benefits and are not available for the purchase of market goods. Thus the consumer must spend a certain number of hours labouring in order to buy goods that enable him to spend time in recreation activities. The value of his recreation may be higher than the wage rate yet the fact that market purchases must be made and the fact that most labourers are constrained by institutional factors (40 hour work weeks, etc.) implies that they spend time in the wage earning capacity. Thus the wage rate is likely not a good measure of the opportunity cost of time in recreation activities.

Some authors have attempted to value the opportunity cost of time as a proportion of income but this is also an inaccurate measure since each individual will place a different value on time spent hunting. Also, the type of recreation activity may dictate the value of time spent. More intensive activities may be valued at rates higher than the wage rate while some less intensive activities may be valued well below the wage rate. The value of time spent in recreation activity can be determined from direct survey questions about the willingness to pay for a day of the activity over and above other costs. This extra market benefit is essentially the value of the time spent in the activity. The willingness to accept compensation measure may be an even better measure of the opportunity cost of time since this measures the amount that the consumer must be compensated in order to give up time spent in the activity. Empirical estimates of the shadow prices of hunting using various measures of the opportunity cost of time are found in Banskota, Adamowicz and Phillips.[50] The most important point about using the direct measures of value to approximate the opportunity cost of time is the flexibility in estimation. The value of the time spent in the activity may be greater than or less than the wage rate depending on the individual's preferences or the particular activity.

The household production function model has been shown to be very flexible in its treatment of the various aspects of the recreation hunting situation. The problems of congestion costs and the value of time have plagued economists for years, and traditional utility maximization techniques have shown little in the analysis of these issues. While the household production model does not solve all of the problems in these areas it does provide a theoretical framework for the analysis of these elements.

A final area where traditional demand models have been consistently weak is the incorporation of supply effects. Travel cost models for hunting activity do not incorporate harvest activities as a significant portion of the analysis. Hedonic price analysis can analyze the value of harvest but actual biological system changes are not allowed by the assumption of a perfectly elastic supply. The household production model can be formulated to account for supply effects.

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[50] Banskota, K., Adamowicz, W.L. and W.E. Phillips, op cit

In order to consider the supply of wildlife in the demand model, the interaction between the supply and demand must be incorporated into the model. Harvesting is the interaction between the supply side of wildlife resources and the demand for wildlife. The supply of harvestable wildlife animals can be incorporated into the production function of the consumer as follows. Let G be the number of game animals harvested (usually a zero or one variable in the case of big game hunting). The consumer has a definite value for a harvested game animal whether it be the value of the meat, the trophy or the extra-market value of capturing the animal. These are the price and quantity components of the harvest, but harvest is not like a market purchase element. There is some chance that no harvest will occur. Thus the accurate perception of the value of harvest will be the price of harvest (Pg) times the quantity of harvest (G) times the probability of harvest p. The probability of harvest can be the harvest rate for the past few years for that particular species. For bighorn sheep as an example the harvest rate would be around 6 percent. The value to the individual hunter would depend on whether or not he captured an animal but the value to the population of hunters would be dependent on the probability of capture.

These variables can be incorporated into the household production function model as follows. The term indicating the value of harvest would be added to the production function as:

$$\mathbf{H = H(\,ThW,\ PhXh,\ PdD,\ Pg\mathit{p}G)}$$

This would then be transfered through the full income constraint into the shadow price:

$$\textbf{Shadow Price} = \mathbf{ThW + PhXh + PdD + Pg\mathit{p}G}$$

This shadow price relates the true value of hunting to the market purchases, the opportunity cost of time, the travel costs and the value of the harvest. Thus a supply side component has been added to the demand model.

This probability component is interesting in that public policy can control the value of p through regulations and thereby control the value of the overall hunting experience. As well the consumer may be able to affect p through technological advancements, higher travel costs or increased market purchases. The stock of wildlife species and the amount of wildlife habitat affects the probability of harvest by determining the numbers of wildlife and the location of stocks. The use of guides and outfitters can affect the value of p. The incorporation of this element into a demand model is an important step. The demand for the recreation activity depends not only on the consumer but also on the supply of wildlife and the institutional factors such as regulation and technology. The probability factor is the linkage between supply and demand. If steps are taken to increase the probability of harvest, the value of the activity will rise since the shadow price will rise.

The incorporation of this supply side component is not the final word on the theoretical consideration of the demand for recreational hunting. However it does provide a linkage between policy, institutions, wildlife stocks, habitat and other concerns. The model is no longer a demand model alone. The analysis of the household production model and its flexibility has resulted in the construction of a theoretical system that considers both supply and demand side. In fact, the lack of communication between supply and demand was noted as a major factor in the analysis of the problem. Perhaps this is a step in the right direction moving towards fine tuning the allocation of wildlife resources, considering various factors from the supply and demand sides.

D. The Use of Economic Values and Determinants

The methods of estimating extra-market benefits presented in the last section are only a part of the total economic analysis of big game hunting in the eastern slopes. The values determined can be used in a benefit cost framework to examine the value of wildlife resources, the incidence of costs and benefits and the effects of policy on the economic impact of recreational hunting. The extra-market values determined can be combined with facts about expenditures on hunting and costs of game management to examine the net benefits of the resource to the people of Alberta as well as non-residents. Expenditure data can be used to analyze regional income effects of both resident and non-resident hunting. Facts about the use and expenditure on guiding and outfitting can be used to examine the viability and growth potential of this industry. All of these rely on the benefit cost framework and although often this tool is not precise and dependant on a number of assumptions, it allows for the identification, organization and weighting of the issues at hand.

The use of benefit cost analysis as the basis for examination of the wildlife resource brings with it two problems, the choice of accounting stance and the method of discounting. The accounting stance is essentially the choice of whether to analyze benefits to a region of Alberta, to Alberta as a whole or to analyze the benefits to society in general. The particular point of contention is the question of indirect benefits. If unemployed resources exist in the area, indirect benefits (benefits from the increase in economic activity) can be considered. If there is no unemployment, however, these indirect benefits would only be transfers from other sectors of the economy (or other countries). Nonresident expenditures in Alberta are an example of indirect benefits that would be considered in a benefit cost analysis. If a "society at large" accounting stance is chosen however, indirect benefits can not be considered since they are transfers of resources.

The second question that must be answered when using benefit cost analysis is the choice of discounting technique and most importantly, the choice of the discount rate. Wantrup points out that the optimum state of conservation would be the maximum present value of the weighted use rates.[51] The use of maximizing present values, however, has many pitfalls. The interest rate chosen for a public resource such as wildlife must be a social discount rate. Estimates of the social discount rate are poor. The market rate of interest cannot be utiltized since it includes measures of risk, inflation and market institutions. The use of present value calculation also presents a more philosophical yet important problem, the question of intergenerational equity. Maximizing present value depends entirely on a decision from the present generation and does not consider the future generation's values for the resource. Page states "Everything is done from the point of view of the present; it is their time preference and everything is discounted back to them".[52] points out These considerations and the concepts of the safe minimum standard urge us to use caution in the intertemporal allocation of resources.

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[51] S.V.Ciriacy-Wantrup, op cit

[52] Page, T. *Conservation and Economic Efficiency: An Approach to Materials Policy.* John Hopkins University Press, Baltimore. 1977. pp. 170.

E. Other Considerations

This chapter has developed the theory of wildlife valuation and it has briefly discussed benefit cost analysis but it has not adequately developed a theory of wildlife resource allocation. The theory of wildlife resource allocation depends on much more than extra-market values and benefit cost analysis. It depends on the combination of institutional factors, demand factors and supply factors. The determination of extra-market benefits depends on the analysis of demand. This analysis of factors that affect the demand for wildlife resource will be an integral part of the allocation theory. The analysis of property institutions is the second component of wildlife allocation theory. Finally, the analysis of the supply of wildlife makes up the third component of wildlfe allocation theory. Facts should be collected in all three of these areas. Facts about the institutions that have evolved in recreational hunting are available from many sources including government regulations and statutes. Facts about the demand for wildlife resources must be obtained from hunters. These facts must include data that can be utilized in the estimation of extramarket benefits and the demand for wildlife as well as data about the socioeconomic characteristics of hunters. Facts about the supply of wildlife resources especially in relation to the consumptive use of wildlife must also be obtained. This section has outlined the theory that can be used in the examination of wildlife resources. The facts required have been pointed out implicitly throughout the analysis. The next section will describe the collection of facts or the inductive stage of inquiry.

IV. Empirical Analysis

This section contains the outline for the second phase of research, the inductive stage. The purpose of the inductive phase is to collect the relevent facts as determined by the deductive stage of research. In the next section the basic tool for the collection of relevent facts, the questionnaire, is discussed. The sampling procedure and response rate is the subject of the second section of this chapter. Descriptive statistics from the sample are presented in the third section and the final section contains a summary of the most important facts and relationships found. The purpose of this chapter is to describe the procedure of the inductive phase of research up to the point where the economic models formulated in the preceeding section can be applied to the data; the combination of the deductive and inductive phases of research.

In order to study the demand for wildlife resources, the characteristics of the hunters (in the case of consumptive use) must be determined. Facts must be obtained about the socioeconomic characteristics of hunters, the activities of hunters (including activity locations, durations, etc.), and the economic aspects of hunting (including expenditures, extra market benefit estimates, etc.). Also, some qualitative data must be obtained about the social institutions related to hunting activity. In order to obtain this data with minimum cost involved, a mail questionnaire was utilized. The mechanics of this questionnaire is discussed in the next section.

A. Questionnaire Design

Questionnaires were developed to elicit the data required. These questionnaires were developed based on earlier work done in Alberta.[53] Initial drafts of the questionnaire were modified in consultation with Alberta Fish and Wildlife Division personnel. Copies of the questionnaires are contained in Appendix A.

There were four different types of questionnaires, resident spring bear hunting, non-resident spring bear hunting, resident big game hunting and non-resident big game hunting. The Grizzly bear hunting season occurs in the spring (April 1 to June 5) and thus was sampled separately from the other hunting seasons which occur in the fall. One resident questionnaire and one non resident questionnaire was designed for each of the spring (bear hunting season) and the fall (general) season.[54]

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[53] W.E. Phillips, D. DePape and L. Ewanyk, *A Socioeconomic Evaluation of the Recreational Use of Fish and Wildlife Resources In Alberta with Particular Reference to the Athabasca Oil Sands Area.* AOSERP report #43. Edmonton:Alberta Oil Sands Environmental Research Program, December 1978. 116 pp.

The four types of questionnaires are made up of five parts: biographic information questions (age, sex, education), hunting activity infomation (trips, miles, days, harvest), economic information (expenditures and extra market benefit estimates), guide use information and general resource use opinions. The four types of questionniares differ in some respects. The non-resident questionnaires only provide activity summaries for up to three trips while the resident questionnaires provide up to seven trip summaries. The non-resident hunters were asked to rate their guides while the resident hunters were not. Also, the spring bear survey asked for opinions about spring bear wildlife resource use while the big game hunting survey asked about wildlife resource use in general. Finally, the big game hunting survey had letter codes on the upper left hand side indicating which type of licence holder the individual was (sheep, goat, moose or elk).

Sampling Design

Inferences can only be made about populations if the sample is random. For example, inferences can only be made about the spring bear hunter population if the sample of spring bear hunters receiving questionnaires is random. Since this study is intended to examine the socioeconomic hunting aspects of big horn sheep, mountain goat, moose, elk and bear in the eastern slopes, questionnaires were mailed to hunters who bought licences for these species. The samples were drawn from Alberta Fish and Wildlife Division computer files. Random samples were selected for the following hunting licence groups: resident black bear, resident sheep, resident elk, resident moose, non-resident black bear, non-resident moose. In the case of resident goat and non-resident sheep, the entire population of licence holders was sent a questionnaire. In the case of resident grizzly, non-resident grizzly and non-resident elk, the total number of licences available were sampled. At the time of selection, not all licence holder data had been keypunched. The total available licences were chosen as the sample and the remaining licences were assumed to be randomly omitted. Table IV.1 contains a summary of the sampling procedure.

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[54] Non-resident means not resident in Alberta.

Mail Out Procedures and Return Results

A double set of mailing labels was obtained from Alberta Fish and Wildlife Division for each sample group. Two sets of labels were required to facilitate a first and second mailing of each questionnaire. The first mailing contained a cover letter, a questionnaire and a return envelope (see Appendix A) and the second mailing contained a return envelope, a questionnaire and a reminder letter. The first mailing of the Spring Bear Survey took place on August 11, 1981 (immediately after a postal strike) and the second mailing of the Spring Bear Survey took place on September 8, 1981. The first mailing of the Big Game Hunting Survey took place on March 25, 1982 and the second mailing took place on April 23, 1982. The returns were collected by Alberta Fish and Wildlife Division and were turned over to the author for processing. Table IV.1 summarizes the return results. Table IV.2 contains a summary of the number of repondents to the first and second mailings.

A high return rate was evident throughout the sample, especially for non-resident hunters. Interestingly, for the Spring Bear Survey, non-residents sampled were issued an "International Reply Coupon" to defer mailing costs and thus hopefully increase response. Non-resident hunters sampled in the Big Game Hunting Survey were not issued these certificates and responded at least as well if not better. In general the response rate was very good.

Processing of Returns

The returns from the survey were collected and sorted for coding. Codes were developed for all possible answers to each of the questions presented in the questionnaire. Using the University of Alberta's central computer and a "Data Entry System" program, the coded responses were keypunched and verified thereby minimizing the possibility of error in either coding or data entry. The returns were catagorized depending on the species code (indicating which type of licence holder the questionnaire was mailed to). Resident hunters were further divided into two other catagories, Active Hunters (those respondents that actually engaged in hunting activity) and Eastern Slopes Hunters (those hunters actually engaged in hunting activity in the eastern slopes region for at least one trip per season). Table IV.3 summarizes the number of respondents that fall

Table IV.1: Big Game Hunting Populations and Sample Sizes for Alberta, 1981

	RESIDENT						NONRESIDENT				
	Grizzly	Black Bear	Sheep	Goat	Elk	Moose	Grizzly	Black Bear	Sheep	Elk	Moose
Population	996	15,915	2,480	42	32,519	68,400	35	458	75	310	1,539
Number Sampled	728	489	1,000	40	500	500	5	360	75	209	500
Percent Sampled	73.1	3.07	40.3	95.2	1.54	0.7	11.4	79.5	100	67.4	32.5
Questionnaires Returned Unopened	68	46	25	2	20	23	0	18	3	8	19
Effective Sample Size	660	443	975	38	480	477	5	342	72	201	481
Questionnaires Returned	362	236	623	26	266	265	5	150	53	137	295
Percent Return	54.8	53.5	63.9	68.4	55.4	55.5	100	43.3	73.6	68.2	61.3
Returned Questionnaires Not Usable	3	2	2	0	0	0	0	0	0	0	0
Usable Sample	359	234	621	26	266	265	5	150	53	137	295

into each catagory. Non-resident hunters were also classified into groups, Total Sample and Active Hunters (indicating those respondents that actually engaged in hunting activity). Non-residents seldom provided information about the location of their hunting activity in Alberta so an Eastern Slopes catagory was not created.

This study is particularly interested in those respondents who hunted in the eastern slopes region. However, in order to observe the relation between those hunters who actually hunted in the eastern slopes and the overall sample, all of the data presented here compare the Active Hunter group with the Eastern Slopes Hunter group (in the case of resident hunters).

Nonresponse Bias

The survey procedures used do not allow for a precise method of determining whether or not respondents are representative of the sample, given the existence of non-respondents. The more successful hunters may be willing to reply more readily thus biasing the sample towards this group. One type of test that can check for some evidence of non-response bias involves a comparison of first and second mailings. Respondents to the second mailing represent a portion of those not responding to the first mailing. If non-response bias exists, some indication of this bias will appear in a comparison of the two mailings. Comparisons of this nature were made for selected variables including, age, income, education, hunting experience, etc.. A Mann-Whitney U Test was utilized to compare the responses to the first mailing with the responses to the second mailing. In all cases the test showed that responses are from the same population (at a 5% level of significance). The only variable that even remotely indicated some nonresponse bias was education, thereby indicating that respondents with greater education responded first. Even results for this variable, however, were not statistically acceptable as an indicator of non-response bias. All of these results support the assumption that the respondents are representative of their specific populations of Sheep hunters, Goat hunters, Moose hunters, Elk hunters, Grizzly Bear hunters and Black Bear hunters.

Table IV.2: Sample Responses to First and Second Mailing, 1981 Alberta Survey

	RESIDENT						NONRESIDENT				
	Grizzly	Black Bear	Sheep	Goat	Elk	Moose	Grizzly	Black Bear	Sheep	Elk	Moose
First Mailing	263	156	460	19	191	171	4	84	43	108	208
Second Mailing	99	80	163	7	75	94	1	45	10	29	87

Table IV.3: Number of Big Game Hunters Active in Eastern Slopes of Alberta, 1981.

	Sheep	Goat	Moose	Elk	Grizzly	Black
Total Sample	623	26	265	266	359	234
Active Hunters	578	24	211	237	310	76
Hunters Active in Eastern Slopes	540	24	75	144	118	22

Table IV.4: Nonresident Big Game Hunter Sample for 1981 Alberta Survey

	Sheep	Moose	Elk	Grizzly	Black
Total Sample	53	295	137	5	150
Active Hunters	52	279	127	3	14

B. Summmary of Selected Statistics

The following section contains a summary of the major statistics collected. The statistics are all presented as mean values (unless otherwise specified) and are presented in catagories of licence type (eg, goat, moose, etc.). Resident statistics are presented in two major catagories, Total Active Hunters (those respondents who actually hunted) and Eastern Slopes Hunters (those who specified at least one trip to the eastern slopes region).[55] Non-resident hunter statistics are presented for active hunters only since non-resident hunters rarely specify where they have actually hunted. While a great deal of the results are specified in this chapter, not all of the results could be placed here without lack of continuity. The reader is referred to the appendices for more data.

Socioeconomic Characteristics

Table IV.5 summarizes the socioeconomic characteristics of resident hunters and Table IV.6 summarizes non-resident characteristics. Notice the differences between eastern slopes hunters and all active resident hunters. Eastern slopes hunters appear to be younger, have slightly higher median incomes, are slightly more educated and hold more Alberta hunting and fishing licences. All of these differences are slight however and in general there seems to be little difference between all active hunters and eastern slopes hunters.

Comparing hunters of different game animals, the differences again appear to be minimal. Sheep and Bear hunters appear to have the highest education levels. Interestingly, those who hunt black and grizzly bear appear to have the lowest levels of hunting experience. The mean rating provides an indication of how the hunter judges hunting in Alberta. Mountain goat hunters find hunting in Alberta to be very good overall, while black bear hunters tend toward the lesser rating of "good". Note that the order of decline of the perception of hunting quality among eastern slopes hunters follows the order of the scarcity (in terms of actual population size) of the species. Mountain goats are very scarce and they yield the highest rating from licence holders. Mountain sheep and

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[55] Some hunters may have actually visited the eastern slopes region but did not specify where they hunted. Thus the actual breakdown between Active Hunters and Eastern Slopes Hunters is not known with complete certainty. In order to describe the characteristics of the eastern slopes hunter however, only those actually visited this region are included.

Table IV.5: Socioeconomic Characteristics 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Age	36.38	36.62	34.02	36.25	33.3	35.02	35.99	35.24	32.97	31.27
	(12.4)	(12.09)	(10.4)	(12.5)	(8.07)	(10.9)	(11.7)	(9.21)	(9.47)	(8.27)
Sex (percent male)	97.3	97.4	99.4	99.6	92	98.6	97.9	97.3	98.7	100
Family Size	3.48	3.41	2.98	3.17	3.85	3.49	3.34	3.60	3.08	3.20
Income (median)	25081	32029	24681	28207	25000	31123	30946	31328	29028	28004
Education (years)	11.5	12.3	12.7	11.9	12.5	12.7	12.6	11.9	12.8	12.7
	(3.59)	(2.93)	(2.95)	(3.01)	(2.06)	(2.77)	(2.68)	(2.67)	(2.96)	(3.41)
Big Game Experience (years)	16.61	17.72	15.30	15.70	16.10	17.68	16.74	14.59	14.94	15.36
	(15.6)	(13.1)	(9.87)	(11.8)	(7.76)	(11.2)	(10.9)	(9.31)	(8.67)	(9.72)
Bird Game Experience (yrs)	17.52	17.76	14.28	15.05	17.1	17.40	16.65	16.07	14.24	15.91
	(14.0)	(13.4)	(10.7)	(12.4)	(8.72)	(11.6)	(11.4)	(9.47)	(9.90)	(8.51)
Mean Rating[1]	2.59	2.59	2.46	2.75	2.0	2.34	2.62	2.57	2.43	2.76
Number of Alberta Licences Held	4.47	5.00	5.1	3.7	7.42	6.61	5.21	5.48	7.65	6.36

[1] NOTE: hunters were asked to rate their hunting experiences on a 1 to 5 rating scale with 1 being excellent, 2 very good, 3 good, 4 poor and 5 very poor. The mean rating gives the average response for the hunter catagory. Thus a mean rating of 2.0 is a higher average rating than a mean of 2.75.

[2] NOTE: standard deviations are provided in parentheses.

grizzly bear are likely the next scarcest resource and they yield a slightly lower rating. The mean rating continues to fall from elk hunters, to moose hunters and finally black bear hunters, who give the lowest rating to hunting.

Occupations for the major catagories of resident hunters are specified in the appendix. In general the largest percentage of hunters are employed as tradesmen or labourers (about 40 to 50 percent in most cases). The next largest catagory is professional and technical workers and the third catagory is usually farm or service occupations. The data in the appendix show that this pattern is followed in almost all cases.

Table IV.7 is a collection of data about where the hunters spent their youth. Notice that by far the vast majority of hunters spent their youth in rural areas or small towns. This distribution is an interesting one since the distribution of population in Alberta is tending to locate more in urban areas. Can we predict a downturn in hunting activity as more people grow up in urban environments ? It is likely that urbanites are removed from the rural institutions of preparation of game and domestic animals for food. They are more likely to become "nonconsumptive" users of wildlife.

Non-residents are in general older than resident hunters, have higher incomes, have more education and are more experienced hunters. The number of licences held by non-resident hunters is low due mainly to the high cost of tags and the fact that non-residents usually hunt primarily one species per trip. The occupations of non-resident hunters have a slighty different structure than the residents' structure (see Appendix B). Non-resident hunters are primarily professionals. The second largest group is usually made up of labourers. Managers, farmers and retired persons make up the majority of the rest of the group. Table IV.8 summarizes the data provided by resondents about where they spent their youth. Non-resident hunters are also primarily from rural or small town areas. Interestingly, those hunters who hunt for the primary trophy species (sheep and grizzly bear) are more likely to have grown up in urban areas. In general the values pointed out for this variable for non-residents are not signifcantly different than those pointed out for residents. Non-resident hunters are primarily American citizens with residents of West Germany making up the second largest catagory.

Table IV.6: Socioeconomic Characteristics Active 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly	Black
Age	46.13	46.05	46.40	44.60	44.40
	(9.87)	(12.4)	(13.3)	(12.3)	(11.4)
Sex (percent male)	98.1	100	97.3	100	100
Family Size	3.47	3.06	2.79	2.50	3.15
Income (median)	>45000	39184	33975	42500	30962
Education (years)	14.56	12.75	12.88	13.2	13.1
	(2.49)	(3.44)	(2.85)	(1.30)	(3.42)
Big Game Experience (yrs)	20.4	23.0	22.8	26.2	20.7
	(10.6)	(11.9)	(13.3)	(10.6)	(12.4)
Bird Game Experience (yrs)	26.8	23.4	21.0	21.0	19.3
	(12.7)	(15.2)	(16.3)	(14.5)	(15.1)
Mean Rating[1]	2.00	2.74	2.50	1.67	2.21
Number of Alberta Licences Held	1.64	1.94	1.59	2.0	1.6

[1] NOTE: hunters were asked to rate their hunting experiences on a 1 to 5 rating scale with 1 being excellent, 2 very good, 3 good, 4 poor and 5 very poor. The mean rating gives the average response for the hunter catagory. Thus a mean rating of 2.0 is a higher average rating than a mean of 2.75.

[2] NOTE: standard deviations are provided in parentheses

Table IV.7: Area Where Spent Youth, Active 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Percent Raised in Rural Area	51.3	58.5	47.1	54.65	46.2	54.0	48.3	56.0	49.0	45.5
Percent Raised in Small Town	24.3	22.3	25.9	22.3	23.1	24.3	23.7	25.3	26.1	27.3
Percent Raised in Urban Area	24.3	19.2	27.0	23.1	30.8	21.7	28.0	18.7	24.8	27.3

Table IV.8: Area Where Spent Youth, Active 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly	Black
Percent Raised in Rural Area	30.2	55.4	47.8	42.5	0.00
Percent Raised in Small Town	28.3	24.1	25.0	28.3	80.0
Percent Raised in Urban Area	41.5	20.4	27.2	29.1	20.0

Hunting Motivation and Activity

It is interesting to observe the motivation for hunting over the different classes (see Appendix B). The tables presented in the appendix derive a score for the hunting motivation specified by the respondent. These scores point out the hierarchy of motivations. For sheep hunters, outdoor enjoyment is most important with hunting for meat and hunting for a trophy a close second and third respectively. Mountain goat hunters specify a similar ranking but the trophy value outweighs meat as the second highest motivation. Elk hunters and moose hunters display a different sort of ranking with outdoor enjoyment and meat ranked nearly equally as most important and all other reasons far behind these two. Interestingly, amongst elk and moose hunters, hunting for a trophy is less important than nearly all other reasons given. Grizzly bear and black bear hunters also rank outdoor enjoyment as the most important reason for hunting, meat as the second most important reason and trophy as the third most important reason.

Non-resident sheep, elk and grizzly bear hunters are almost equally motivated by outdoor enjoyment and trophies. Non-resident moose and black bear hunters however place a much smaller emphasis on trophies and hunt primarily for outdoor enjoyment and meat. Note that elk hunters fall into the same catagory as the more trophy oriented hunters of sheep and grizzly bear. These results are listed in Appendix B.

Table IV.9 summarizes the hunting activity data for resident hunters. Firstly, hunting activity is more intense in the eastern slopes region than in the other regions in the province. Eastern slopes hunters take more trips, spend more days and travel further than the total active hunters. Among the hunter catagories, goat hunters appear to be the most intense, spending more time hunting and travelling further than any other group. Sheep hunting is next in intensity of hunting activity with moose and elk hunting taking third and fourth positions. Grizzly bear and black bear hunting cannot be accurately compared with these other catagories since the bear hunting seasons occurs in the spring.[56] Comparing the two bear hunting seasons however it is easy to see that grizzly hunting is far more intense than black bear hunting. Harvest statistics for the eastern slopes region provided in the appendix point out that 49% of hunting trips taken by goat hunters result in a harvest of an animal (not necessarily a goat but any one of many species). About 20% of hunting trips taken by sheep and elk hunters result in harvest and about 15% of trips taken by moose hunters result in harvest. A similar comparison can be made between black bear and grizzly bear hunters. Harvest rates are higher for grizzly bear hunters than they are for black bear hunters. This summary of hunting activity points out a major fact. Even though the socioeconomic characteristics of all of the hunting groups are quite similar, the intensity of their activity is quite different. A heirarchy can be established for intensity of hunting activity which is likely goat hunting, sheep hunting, grizzly bear hunting, elk hunting, moose hunting and black bear hunting respectively.

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[56] Black bear hunting is also allowed in the fall but the survey was sent out with specific reference to spring bear hunting.

Non-resident hunting activity also follows this type of hierarchy. Sheep hunters spend the greatest number of days hunting, followed by elk hunters, grizzly bear hunters, moose hunters and black bear hunters respectively. Non-residents in general have higher success rates than resident hunters (see Appendix B) and although they take fewer trips, they spend more days per trip.

Expenditures

Expenditures on hunting are a major part of the economic analysis of hunting activity. The data acquired about expenditures can be used to determine extra-market benefits (through the travel cost or hedonic price technique) or it can be used to determine regional impacts of hunting activity. Table IV.11 lists the mean expenditures by catagory for resident hunters. Notice again the appearence of the hierarcy of hunting activity. Goat hunters spend the most on hunting, sheep hunters are second, then moose, elk, grizzly bear and black bear. This hierarchy corresponds to the fact that goat hunters travel further and therefore must spend more money to engage in hunting activity. Goat hunters also tend to use guides more than any other group of hunters.

Non-resident hunting expenditures are presented in two tables; table IV.12 presents the total expenditures on hunting and table IV.13, summarizes hunting expenses in Alberta. Notice the magnitude of hunting expenses by the non-resident hunters in comparison to resident hunters. Non-residents spend several times as much money in total, and in Alberta per person than do residents. From an economic standpoint one must realize that this expenditure has not been redistributed within the province previously and this respresents new money that generates additional economic activity. From an

Table IV.9: Hunting Activity of 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Number of Trips per season	3.16	3.34	2.32	1.75	4.46	4.13	3.55	3.87	2.61	1.95
	(2.16)	(2.21)	(1.52)	(1.26)	(2.19)	(2.16)	(2.02)	(1.90)	(1.64)	1.65)
Number of Days per Season	11.5	12.17	6.24	3.68	22.39	17.42	12.12	15.16	6.82	3.77
	(16.1)	(25.8)	(4.57)	(3.58)	(22.9)	(9.52)	(21.5)	(22.9)	(4.68)	(3.90)
Miles Travelled One Way Per Season	469.70	428.31	266.02	141.03	940.42	611.77	479.50	564.87	283.53	121.04
	(602.3)	(572.2)	(270.7)	(177.6)	(763.6)	(842.9)	(658.7)	(641.8)	(293.3)	(134.9)
Days per Trip per Hunter	4.80	4.47	3.32	1.757	5.36	5.30	4.06	4.25	3.01	2.03
	(8.51)	(9.76)	(2.51)	(2.90)	(6.75)	(9.07)	(8.51)	(6.35)	(1.87)	(1.60)
Miles per Trip per Hunter	179.86	146.89	114.86	80.59	225.27	165.56	146.95	157.91	111.04	65.80
	(250.9)	(214.8)	(126.9)	(121.1)	(204.6)	(231.6)	(215.9)	(197.8)	(111.5)	(55.88)
Party Size per Trip per Hunter	3.06	3.03	2.12	2.11	2.63	3.08	3.12	2.56	2.18	2.20
	(6.13)	(3.66)	(0.98)	(0.90)	(1.32)	(5.74)	(4.59)	(0.82)	(0.90)	(0.88)

[1]NOTE: standard deviations are provided in parentheses.

Table IV.10: Hunting Activity of Active 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly	Black
Number of Trips per Season	1.13 (.375)	1.14 (.487)	1.18 (.573)	1.0 (000)	1.29 (.610)
Number of Days per Season	16.67 (13.6)	12.97 (2.89)	7.35 (8.56)	8.33 (3.21)	6.56 2.53)
% of Hunting Time Spent in Alberta	37.75 (30.8)	43.86 (34.1)	45.05 (36.3)	54.5 (6.36)	25.0 (24.15)
Party Size per Trip	3.57 (1.69)	4.10 (8.63)	2.32 (12.97)	2.33 (1.53)	2.50 (1.00)
Days per Trip per Hunter	14.75	11.37	6.23	8.33	5.08

[1]NOTE: standard deviations are presented in parentheses

Table IV.11: Average Expenditures: 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Travel Costs	179.29	199.91	145.86	103.20	652.29	333.58	189.93	220.84	157.91	113.18
Lodging costs	19.97	18.15	13.51	7.57	96.63	32.89	19.28	31.29	14.51	0.00
Food Costs	76.49	84.28	72.16	39.07	312.95	168.58	85.02	107.44	78.42	48.41
Beverage Costs	17.72	21.37	15.99	14.34	55.03	30.17	19.40	22.67	13.24	17.36
Rental Costs	3.70	0.69	4.98	0.99	56.33	8.69	1.15	6.00	4.19	2.27
Guide Costs	5.14	7.85	32.90	0.00	170.30	37.56	6.50	14.00	11.61	0.00
Ammunition Cost	26.09	28.74	23.67	10.72	63.48	41.86	32.77	31.08	27.37	9.86
Service Costs	24.98	34.65	78.29	36.51	312.43	121.12	45.84	37.67	73.32	27.27
Other Costs	22.71	33.08	43.56	5.53	169.79	66.12	8.90	10.13	25.36	0.91
Total Variable Costs	376.09	428.74	430.92	217.12	1889.2	840.6	408.89	481.12	405.93	219.27
	(406.0)	(500.0)	(537.7)	(226.9)	(509.1)	(981.0)	(422.6)	(417.8)	(402.7)	(227.4)
Total Capital Costs[1]	302.58	582.26	212.42	267.50	822.90	731.31	549.07	392.47	217.47	866.25
	(850.3)	(2048)	(817.3)	(1580)	(1346)	(2468)	(1957)	(1247)	(818.4)	(2891)

[1] NOTE: capital cost are determined by multiplying the total spent on the item times the percent that the item is used for hunting in the season. If a vehicle cost $10,000 and the use for hunting was 5% the capital cost will be $500.

[2] NOTE: standard deviation are presented in parentheses.

Table IV.12 Average Expenditures: Active 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly	Black
Travel Costs	1045.65	569.84	486.18	583.33	1229.79
Lodging Costs	193.52	140.76	92.57	0.00	215.00
Food Costs	147.11	118.19	123.73	20.00	120.36
Beverage Costs	50.61	30.74	36.17	34.00	41.7962
Rental Costs	15.87	11.57	5.16	0.00	7.86
Guide Costs	5074.81	870.68	518.70	833.33	594.29
Ammunition Costs	16.19	13.75	11.33	.80	22.57
Service Costs	436.10	173.18	53.61	433.33	43.21
Other Costs	218.27	27.04	24.94	0.00	60.71
Total Variable Costs	7756.84 (3148)	2248.00 (2448)	1386.48 (1118)	1894.00 (760.0)	2585.57 (3310)

[1] NOTE: Standard deviations are presented in parentheses.

Table IV.13: Average Expenditures in Alberta: Active 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly	Black
Travel Costs	480.61	286.81	251.39	106.67	489.79
Lodging Costs	182.23	109.70	77.86	0.00	170.36
Food Costs	132.11	104.53	95.92	16.67	89.64
Beverage Costs	50.13	28.53	31.19	33.33	31.07
Rental Costs	15.87	11.57	5.08	0.00	2.86
Guide Costs	4717.04	835.02	501.84	833.33	594.29
Ammunition Costs	9.17	13.07	4.64	.80	8.93
Service Costs	393.66	118.50	34.68	233.33	293.21
Other Costs	178.84	19.56	21.48	0.00	35.71
Total Variable Costs	6756.03 (3316)	1823.18 (2335)	1059.18 (951.1)	1303.00 (1380)	1465.86 (1326)

[1] NOTE: Standard deviations are presented in parentheses.

efficiency point of view, non-resident hunting is very beneficial to Alberta from a regional accounting stance. If a society-at-large accounting stance is used these non-resident expenditures can only be viewed as true benefits if there is resource unemployment in the economy. Non-resident expenditures also follow a similar order of size of expenditures as residents with sheep hunters spending the greatest amount, followed by elk hunters, grizzly bear hunters, moose hunters and black bear hunters. By far the major component of these expenditures is the cost of guides and outfitters. As mentioned in an earlier section, one of the arguments for allowing non-resident hunters the right to hunt in Alberta is the equity consideration of the livelihood of the guiding and outfitting industry. Non-resident hunters may also be efficient in economic terms if the regional impact of their activities are sufficient enough to override the loss of benefits to resident hunters.

C. Comments and Conclusions

This section has outlined the inductive phase of research as it was applied to the problem of collecting data about the consumptive use of wildlife resources. The major conclusion of this section must be that although there are few differences in income, age, and other socioeconomic factors among groups of hunters, there are definite differences in their activity levels and intensity. This inference holds whether speaking of resident or non-resident hunters. This conclusion should be of great concern to resource managers. The problem identified in an earlier section is a lack of definite property rights or the lack of communication between the supply and demand for wildlife resources. An attempt to predict demand from socioeconomic characteristics will likely result in severe error in estimation. Without the consideration of the institutional factors which make goat hunting more intense than moose hunting, for example, the demand for wildlife resources cannot be accurately estimated. The data outlined in this section clearly reveal that there are different groups of hunters. In order to communicate the hunter's demand for wildlife resources to the suppliers of wildlife (government agencies) these groups must be separated in their activities, reactions to policy and influences on supply. The economic analysis that follows continues to stratify the group of hunters. The role of the economic analysis is to provide an understanding of the elements of the demand for wildlife resources, to provide insight into the structure of demand and supply and to begin the development of a mechanism for the allocation of wildlife.

V. Economic Analysis

The purpose of this section is to combine the results of the inductive phase of research with the logic, theory and models discovered in the deductive phase. In other words, the data collected from the survey described in chapter four is applied to the models discussed in chapter three. The purpose of this section is to see if the facts coincide with the theoretical models constructed in chapter three. However, even if these facts do agree with current theory, the problem is not yet solved. This chapter contains only an examination of the data that applies to current theory. Current theory however, is lacking. In order to solve the property rights problem this analysis must go beyond the application of data to econometric models. Nevertheless, the models developed in this section aid in understanding the factors that influence demand. The selection of a special sample from each set of survey returns is discussed in the first section. The results of the direct technique of extra-market benefit evaluation for both the selected sample and the total sample are presented in the second section. The hedonic price models are discussed in the third section and the fourth section contains a discussion of the household production function approach to evaluating wildlife resources. The fifth section contains a discussion of travel cost models. A concluding section contains an evaluation of the various approaches and a discussion of the relevence of these models to an economic analysis of the problem.

A. Selecting a Sample for the Comparison of Benefit Estimation Techniques

Each questionnaire received was coded and any questions that were not answered properly were labeled so that they could be removed before any analysis began. For example, some respondents when asked what they would be willing to pay for a day of hunting responded that the value was priceless or that this was a ridiculous question. These responses were removed from the calculation of the average values presented above. Similar problems occurred for most of the important variables. Whenever the values reported were suspect or if no values were presented when they should have been (e.g., when expenditures were not specified) these cases were deleted from the sample. In particular, the variables which displayed such problems were WTP, COMP, the number of days of hunting (in some cases these were not specified even though expenditure data was presented), the expenditures on hunting, the number of miles travelled, income of the respondent and the years of hunting experience. In order to perform the statistical procedures necessary for the hedonic price and travel cost methods of extra-market benefit estimation, these missing cases were removed from the data sets. All of the catagories of hunters were subjected to this procedure to derive a "selected sample" of data. This selected sample permitted analysis with no problem of missing cases or incomplete data. It also facilitated the comparison between hunter groups with exactly the same selection operations and statistical procedures being performed on each group. The selected sample however, significantly reduced the number of cases available for evaluation but increased confidence in the estimates. The sample sizes for the hunter groups once the selection procedures had been completed were:

1. Resident Sheep: 216 cases
2. Resident Elk: 112 cases
3. Resident Moose: 104 cases
4. Resident Grizzly: 174 cases
5. Resident Black Bear: 55 cases

Selection procedures for eastern slopes hunter groups left too few cases to analyze for the moose, elk and black bear data sets so the selected samples are for total hunter data. Selection procedures for non-resident hunters resulted in too few cases as well. Consequently only resident hunter groups were used for the analysis.

B. The Direct Method of Measurement of Extra-market Values

Two questions concerning the value of hunting over and above all other costs were asked of all respondents. The first question asked "What are you willing to pay, over and above all other costs, for a day of big game hunting in Alberta ?"[57] The second question asked "How much would you have to be paid not to hunt big game in Alberta for one year?"[58] The first of these questions elicits the "willingness to pay" (WTP) for hunting while the second question elicits the "compensation value (COMP). The assumptions and theoretical underpinnings for these concepts has been discussed in chapter three. The values obtained by these questions are presented in table V.1. The third value presented in table V.1 is the average compensation value per day calculated by dividing the COMP value from the questionnaire by the average number of days of hunting. This calculation puts WTP and COMP on the same per day basis.

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[57] Spring bear hunters were asked what they are willing to pay for a day fo spring bear hunting.

[58] Spring bear hunters were asked how much they would have to be paid not to hunt bear in the spring

Note the similarity in the values for all of the various groups. Observing the order of magnitude in the direct measures, eastern slopes moose hunters have the highest average WTP value, considerably higher than the values for the next two highest groups, grizzly bear and sheep hunters. The unreasonably low value of WTP for black bear hunters can be rationalized by the fact that black bear hunters were asked to value a day of hunting in the spring. The availability of an alternative season exists for black bear (in the fall) while it does not exist for grizzly bear hunters. Thus one would expect WTP values for spring black bear hunting to be low.

Compensation value per season depicts a different ranking of values. Sheep hunters place the highest value on a season of hunting with goat hunters and elk hunters placing the second and third highest values. The value of compensation per day however displays quite different results. As pointed out in the theoretical synthesis, the average value of compensation demanded is usually higher than the average value of willingness to pay. While the reasons for this difference have not yet been fully discovered, income effects and the loss of rights to take part in the activity are thought to play some role in making compensation the higher value. However, this situation does not always occur here. In fact, the compensation demanded per day is quite similar to the willingness to pay per day. Estimation of compensation on a per season basis may have eliminated the biases that result in differences between compensation and WTP on a per day basis. A further analysis of these variables is presented later in this section.

The consumptive value of the wildlife resource in the eastern slopes is apparent from the figures presented in table V.1. For example, if the value for a day of sheep hunting is $72.94 per day, Alberta sheep hunter's WTP equals $72.94 times the number of hunters (approximately 2500 active hunters), times the number of days per hunter (approximately 17.42 per season) for a total of $3,176,530. This figure is the value to consumptive users alone and does not include the values to other users. When this figure is compared to management costs, the net benefit of the resource is significant. The

Table V.1: Extramarket Benefit Estimates: 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
WTP per Day	72.01 (167.1)	63.00 (91.23)	70.48 (108.3)	53.20 (68.44)	68.04 (41.39)	72.94 (104.4)	69.60 (118.3)	92.11 (272.5)	78.46 (144.2)	37.32 (530.8)
Compensation per Season	633.76 (865.9)	813.17 (1237)	670.05 (1016)	297.69 (413.5)	1173.6 (1475)	1334.95 (1570)	1014.8 (1453)	894.32 (1198)	761.16 (1069)	389.39 (530.8)
Compensation per Day	55.11	66.82	107.38	80.89	52.42	76.63	83.73	58.99	111.61	103.29

[1] NOTE: Standard deviation are provided in parentheses.

Table V.2: Extramarket Benefit Estimates: 1981 Nonresident Big Game Hunter Sample for Alberta

	Sheep	Moose	Elk	Grizzly	Black
WTP per Day	246.53	93.38	61.50	116.67	37.08
	(302.8)	(122.3)	(47.17)	(160.7)	(43.09)
Compensation per Season	432.15	321.73	316.01	100.00	355.56
	(1116)	(491.5)	(394.1)	(100.0)	(350.4)
Compensation per Day	25.92	24.81	42.99	12.00	54.20

[1] NOTE: Satndard deviations are provided in parentheses.

provincial government's expenditure on wildlife services in total in the province is only $4,157,000 for the 1980-81 year. The extra-market benefit from this one species alone accounts for a major portion of the expenditures on wildlife in total. While comparison between the hypothetical WTP figure and the actual dollar figure is difficult, it is important that the magnitude of these estimates be recognized.

Table V.2 contains a summary of the responses to the WTP and COMP questions for non-residents. The WTP estimates for non-residents are higher than similar estimates for resident hunters for the hunter groups sheep, moose and grizzly bear. The compensation benefit estimates however are much smaller for all of the non-resident hunter groups compared to the resident hunter groups. Also notice that the COMP per day values are much smaller that the WTP values for the non-resident sample (except for black bear hunters). This result is in contradiction to the empirical findings of other researchers. Perhaps the reason the WTP per day is higher than COMP per day is the fact that non-resident hunters have many more substitutes for hunting activity that are less costly than travelling to Alberta to hunt. Therefore their willingness to pay for a day of hunting may be quite large relative to the compensation demanded since they would not have to be paid very much not to hunt in Alberta since other substitute areas are still available to them. This explanation may also account for the low compensation values of non-resident hunters relative to resident hunters. The availability substitute sites for hunting reduces the amount that they would have to be paid to give up hunting in Alberta for one year.

This analysis has brought up yet another element in the question about the difference between WTP and COMP; the availability of substitutes. Resident hunters have no good substitutes for hunting that are offered at reasonable costs. Therefore their compensation values are quite high. Non-resident hunters however have other sites available and thus their welfare is not decreased as much by not being able to hunt in Alberta. Viewing this problem from the side of willingness to pay for a day of hunting however, the non-resident can likely afford to pay more (as they have higher incomes) and has already incurred higher costs to come to Alberta to hunt so the amount he or she would be willing to pay over and above all other costs is higher than a similar type of value estimate for a resident hunter. This analysis indicates the importance of institutional structure in understanding the allocation of resources even from the standpoint of extra-market benefit evaluation.

The direct extra-market benefit estimation technique used in the survey has been briefly presented. The next sections contain in depth analyses of the other methods of benefit estimation and compares them to the direct method. Before this analysis is presented however, the results of the direect method are analyzed to take into account those respondents who did not respond accurately to certain questions. This analysis is the subject of the next section.

The values for the direct method technique of eliciting extra-market values presented above are average values from each entire hunter group. The values presented in table V.3 are the average values from the willingness to pay and compensation demanded questions for the selected sample. Notice that the value of WTP per day is generally quite similar to the value of COMP per day. This similarity again illustrates that the tendency for compensation values to be much higher than WTP values is generally eliminated by the use of a "per season" compensation question.

The theory discussed in chapter three suggested that another relation between WTP and COMP may be that WTP is a price variable and COMP is the total benefit value. In this case, WTP will be the average price of the activity and COMP will be the area under the demand curve. One way of testing this relation is to develop a demand curve using COMP as the dependent variable and days in the activity as one of the independent variables. The first derivative of this equation with respect to days would provide the marginal value of a day. This marginal value should be similar to the average WTP value elicited if the WTP is in fact the marginal COMP value. Equations of the form;

$$\ln \mathrm{COMP} = f(\ln \mathrm{DAYS}, \ln \mathrm{HARVEST}, \ln \mathrm{INCOME})$$

were estimated for each of the five hunter groups (see tables V.4 to V.8). The first derivative of each function with respect to days (evaluated at the mean COMP and DAYS value) gives the marginal value of a day presented in table V.3. The Marginal Value of a Day (COMP) is presented for sheep, moose and elk hunter groups only since the coefficient of DAYS in the COMP equations for grizzly and black bear hunter groups is not statistically significant. The marginal values derived from these equation are not very different from the values of WTP presented but they are not as similar as the values for average COMP

Table V.3: Extramarket Benefit Estimates by Hunter Group (selected sample, Alberta, 1981)

Type of Value	Sheep	Moose	Elk	Grizzly	Black Bear
Compensation per season	473.05	187.73	194.68	140.68	41.88
WTP per day	41.39	33.26	39.96	39.88	22.86
Average COMP per day	45.28	32.14	30.42	30.58	16.82
Marginal value of a day (COMP)	25.30	29.62	20.47	----	---
Marginal value of a day (Hedonic)	101.39	107.81	61.53	170.46	154.84
Average value per day (TRCOST)	18.67	16.99	14.50	27.02	38.21
Price "D"	30.20	24.98	22.76	36.49	32.63
Average Expenditures per season	484.01	185.08	225.79	229.27	141.89
Average Number of Days Hunted	10.44	5.84	6.40	4.60	2.49
Average Travel Cost per Day	18.88	15.41	17.49	18.41	26.76

and average WTP. This result may provide some insight into further research in this field. If a compensation value is elicited, it should be on a per season basis. This allows the use of either per day measures by dividing the compensation by the number of days or per season measures when called for.

In observing the average value of compensation demanded per season note that the value is quite similar to the average expenditures per season. This relation can be observed in the selected sample (table V.3) or the total sample (table V.1). Expenditures appear to be closely related to the extra–market value of the activity. This finding adds some confidence to the hedonic price technique which utilizes expenditures as the main variable. A final observation about the direct method results are that the heirarchy of hunting intensities are again apparent. The values elicited from sheep hunters are higher than the values elicited from the other groups. Also, as expected, black bear hunting provided the lowest extra–market benefit.

The uses of WTP and COMP in benefit cost analysis have been pointed out in chapter three. If the WTP and COMP estimates are the same on a per season basis then naturally there is no difference as to which measure is used to estimate extra–market values. If, however, the values for WTP and COMP are different, the particular situation will dictate which value is to be used. For example, if there is to be a loss of hunting days due to some project or activity, this welfare loss should be measured in terms of the compensation demanded (a right taken away). If a welfare gain is to be expected from a change the appropriate measure of value would be WTP (rights not affected). In any case the estimates of value and the maintenence of the heirarchy of intensities lends confidence to this technique. The use of these values in the solution of the problem is not yet clear however. These values and their meaning are re–examined below in this chapter and their significance to wildlife policy is pointed out more clearly.

C. Hedonic Price Models

As pointed out in chapter three, the hedonic price method of determining extra–market benefits has its roots in household production theory. This theory utilizes a framework different from traditional economic analysis which maximizes utility from goods purchased. In the household production theory, utility is produced by a set of characteristics that make up the good or activity. For example, a house is made up of characteristics such as square footage, the number of bedrooms, the size of the lot, etc.. Household production theory develops a framework for the valuation of each element in this "good". In a similar manner, hunting can be thought of as a good made up of the characteristics days spent hunting, harvest of animals, etc. Thus the utiltiy from the good called hunting is actually produced by the number of days in the activity and the harvest of animals (and other characteristics that can be included in the activity). The hedonic price function is a regression equation with the expenditures on hunting activity the dependent variable and the quantity of days and harvest the independent variables. This function shows the relationship between the inputs in the individual's "production function" for the activity and the expenditures on the activity. The individual is expected to minimize his expenditures on hunting activity while maximizing utility from the good. The first derivative of the expenditure equation with respect to each independent variable provides the "implicit price" of the independent variable. This price can then be used in a demand function that takes the following form for the demand for hunting days;

Days = f(Implicit Price of Days, Implicit Price of Harvest, Other Socioeconomic Variables)

The marginal value of hunting days can be determined from the demand function. The assumptions involved in using this technique have been pointed out in chapter three.

The expenditure equations for each of the five selected samples are presented in tables V.4 through V.8. Each equation takes the form;

ln COST = f(ln DAYS , ln HARVEST).

COST is the total per season expenditure on hunting activity, DAYS is the number of days engaged in hunting activity and HARVEST is the number of big game animals bagged. In order to provide a non-linear expenditure function a double log form was used. All of the coefficients are significant at a 10% level except for the HARVEST coefficient from the moose hunter sample (table V.6). The partial derivative of expenditures with respect to days gives the implicit price of a day or the change in expenditures for a change in days. Utilizing this measure, an implicit price per day for each hunter can be computed by using the number of days and the total expenditures of each hunter. These individual implicit prices form the price variables used in the demand equation;

Table V.4: Regression Results: 1981 Alberta Sheep Hunters

Dep. Var.	Constant	DAYS	HARVEST	Price "D"	Price "H"	EXPER	INC	TRCOST	R²
COST	4.577 (20.77)	.6403 (7.01)	.4049 (2.541)						.231
DAYS	2.063 (5.095)			-.2926 (5.523)	.0914 (5.161)	.1812 (3.735)	.0544[1] (1.555)		.223
COMP	4.976 (3.78)	.5588 (2.48)	.3970[1] (1.023)				-.0224[1] (.1773)		.038
TRCOST	2.859 (5.252)	-.2922 (3.139)	.1611[1] (1.026)			.2321 (3.215)	.0150[1] (.2937)		.074

NOTE: [1] indicates coefficient not significant at 10% level.

Table V.5: Regression Results: 1981 Alberta Moose Hunters

Dep. Var.	Constant	DAYS	HARVEST	Price "D"	Price "H"	EXPER	INC	TRCOST	R²
COST	3.929 (13.92)	.7485 (4.87)	-.207[1] (.5311)						.199
DAYS	2.297 (4.577)			-.2200 (2.742)	.1206 (3.394)	.0708[1] (.9112)	-.0212[1] (.4983)		.176
COMP	4.918 (3.35)	.9216 (2.99)	.9467[1] (1.209)				-.1478[1] (1.105)		.144
TRCOST	2.977 (4.599)	-.0964[1] (.7326)	-.1584[1] (.4822)			-.0961[1] (.9566)	.0165[1] (.2947)		.027

NOTE: [1] indicates coefficient not significant at 10% level.

Table V.6: Regression Results: 1981 Alberta Elk Hunters

Dep. Var.	Constant	DAYS	HARVEST	Price "D"	Price "H"	EXPER	INC	TRCOST	R^2
COST	4.149	.6169	.8616						.247
	(16.05)	(4.73)	(2.88)						
DAYS	1.419			-.3537	.1205	.1523	.0939		.244
	(2.705)			(4.578)	(4.176)	(2.161)	(1.940)		
COMP	4.650	.6730	.4476[1]				-.2329[1]		.039
	(5.48)	(2.03)	(.5991)				(.8475)		
TRCOST	2.030	-.4364	.5814			.2192	.1029[1]		.161
	(2.891)	(3.682)	(2.168)			(2.234)	(1.581)		

NOTE: [1] indicates coefficient not significant at 10% level.

Table V.7: Regression Results: 1981 Alberta Grizzly Hunters

Dep. Var.	Constant	DAYS	HARVEST	Price "D"	Price "H"	EXPER	INC	TRCOST	R²
COST	4.271	.7080	1.344						.255
	(21.99)	(6.05)	(3.080)						
DAYS	1.883			-.2070	.0834	-.033[1]	.1903		.255
	(6.699)			(3.594)	(3.935)	(.5082)	(1.840)		
COMP	4.242	.4233[1]	1.027[1]				-.0244[1]		.037
	(5.59)	(1.56)	(1.603)				(.0653)		
TRCOST	2.749	-.3306	.7025[1]			.0476[1]	.2967		.088
	(7.904)	(3.170)	(1.788)			(.5281)	(2.053)		

NOTE: [1] indicates coefficient not significant at 10% level.

Table V.8: Regression Results: 1981 Alberta Black Bear Hunters

Dep. Var.	Constant	DAYS	HARVEST	Price "D"	Price "H"	EXPER	INC	TRCOST	R²
COST	4.344 (21.07)	.5751 (3.36)	2.250 (2.623)						.281
DAYS	21.92 (3.422)			-.2116 (1.930)	.0234[1] (.4917)	-.097[1] (.7340)	-.038[1] (.1996)		.089
COMP	2.609 (1.91)	.2170[1] (.449)	2.779[1] (1.132)				.4644[1] (.6787)		.034
TRCOST	2.940 (4.433)	-.3153 (1.720)	.8802[1] (.9476)			.3231 (1.806)	-.093[1] (.3650)		.147

NOTE: [1] indicates coefficient not significant at 10% level.

ln DAYS = f(ln Price "D", ln Price "H", ln INCOME, ln EXPERIENCE)

In this double log demand curve Price "D" is the implicit price of days variable, Price "H" is the implicit price of harvest variable, INCOME is the average annual income and EXPERIENCE is the number of years of hunting experience. The results of these equations for each hunter group are presented in tables V.4 through V.8. In all cases the implicit price variables are statistically significant at a 5% level (except the implicit price of harvest in the black bear sample). The socioeconomic variables performed poorly in the regression equations, particularly income which was seldom statistically different from zero at a 10% level.

The demand equations constructed are now used to derive marginal values for the activities. The formula for calculating the marginal value of a day is;

- a EXPEN / b DAYS

where EXPEN is the average expenditures, DAYS is the average number of hunting days, "a" is the coefficient of the DAYS variable in the expenditure equation and "b" is the coefficient of the implicit price of days variable in the demand equation. The logic of this formula is as follows; "a" is the change in expenditures for a change in days and "b" is the change in days for a change in the implicit price of a day. When multiplied by the mean values of expenditures and days this provides the marginal value of a day or the amount the consumer would be willing to pay for an additional day of hunting. The marginal values computed for each selected sample are given in table V.3 under the label Marginal Value of a Day (Hedonic). Also given in table V.3 is the average value of the implicit price of days variable, Price "D". These values are discussed in a section below in order to compare the various methods of valuation.

Before closing this section on the hedonic method of valuation some interesting facts must be pointed out. Firstly, the Price "D" variable is always negative as expected since it is a price variable but the Price "H" variable is positive in all cases, indicating that days of hunting activity and harvest are substitutable. As expected, the number of days engaged in the activity increases with the years of experience and the income elasticity is also positive (when significant). The values of the constants are positive in all cases and highly significant. This positive constant may point out that hunters incur some cost even when they do not engage in hunting activity. Hunters likely do incur some costs on such items as firearm maintenence. From this analysis we can now turn to the household production functionm approach to wildlife resource analysis. This theory underlies the hedonic price model.

D. The Household Production Function Approach

The theoretical framework presented in chapter three describes the household production approach to consumer theory not as a valuation technique but as a completely new approach to the analysis of outdoor recreation. While this approach is the basis for the hedonic price valuation technique it is not necessarily limited to the analysis of extra-market values. In fact, this section contains the presentation of household production approach as a powerful tool in the study of wildlife management policy.

Chapter three above outlined the theoretical base up to the point where shadow prices for hunting can be obtained. The shadow price includes the variable costs of hunting (travel costs and market purchases), the captial costs of hunting (purchases of guns, hardware) and the opportunity cost of time. Instead of valuing the opportunity cost of time at the wage rate as most economic approaches would, this theory suugests that the compensation value demanded may be a better measure of the opportunity cost of time. The compensation value measures the amount that the hunter must be paid to stop hunting for one season. This value may represent the value of his time spent engaged in hunting activity more accurately than would the wage rate for market activities. As well, the compensation approach allows some flexibility for the valuation of the opportunity cost of time in different intensities of activities. Instead of valuing the opportunity cost of time spent trophy sheep hunting and moose hunting equally, as would an approach that used income as a measure of the cost of time, this approach values the two different activities separately. This amalgamation of the direct and household production function approach to the economic analysis of wildlife resources implicitly suggests that a more general form of analysis must be undertaken, one that combines the advantages of the various approaches.

Table V.9 presents the shadow prices for the various hunter groups. All of the figures are on a per day basis. This basic shadow price represents the total cost for a day of hunting to each individual. Although it is quite simple in its calculation, the size of the values point out the importance of the resource. The shadow prices presented here come from the utiltiy function of the form;

$$U = U(H,S)$$

where H is the "good" hunting. Hunting is produced by the characteristics market purchases, travel costs and the opportunity cost of time in the form;

$$H = H(ThW, PhXh, PdD)$$

where Th is the time spent hunting, W is the opportunity cost of time (the wage rate in a strict neoclassical model and the compensation value in the model discussed here), Ph is the price of market purchases, Xh is the quantity of market purchases, Pd is the price of travel and D is the distance travelled. This basic model provides the shadow prices estimated in table V.9. Notice that the heirarchy among hunter groups again appears. Sheep and goat hunters although likely not different in socioeconomic characteristics are quite different in the costs of their hunting activities. This fact strengthens the assumption of the use of a measure other than income as the value of the opportunity cost of time. Using income would misrepresent the value of time. It would understate it in the cases of sheep and goat hunters and may overstate it in other cases.

The estimates of shadow prices presented here are not to be mistaken as extra-market values. It is possible that if the hunting resource did not exist this money would be spent in other activities. Nevertheless, these values do have some interesting uses. By redefining the utility function to include the effects of congestion (as discussed in chapter three) the value of congestion could be derived as well as the relative effect of congestion on time spent in the activity, costs incurred, etc.

An even more complex form of the production function for hunting could be specified to include harvest. Instead of hunting activity being "produced" by market purchases, travel costs and the opportunity cost of time, a value of harvest function could be added as follows;

$$H = F(ThW, PhXh, PdD, Pg\rho G)$$

where Pg is the value of the game animal, ρ is the probability of harvest, G is the quantity of harvest and the other variables are as described above. The value of the game animal could be represented by the value of the meat in the case of a moose or the value of a trophy in the case of sheep or goat hunting. This formulation would provide a link

Table V.9: Shadow Price Per Day: Alberta Eastern Slopes Hunters, 1981

Hunter Group	Variable Costs	Capital Costs	Time Costs	Shadow Price
Sheep	48.25	41.98	76.63	166.87
Goat	84.38	36.75	52.42	173.55
Moose	31.74	25.89	58.99	116.62
Elk	33.74	45.30	83.73	162.77
Grizzly	59.52	31.89	111.61	203.01
Black Bear	58.17	229.77	103.29	391.23

between the supply and demand for wild animals. In particular, the probability of capture is important since it is interrelated with the expenditures on hunting. The hunter will try to increase expenditures until the probability of harvest is at a satisfactory level. If, for example, the hunter wishes to increase the chances of his capturing a game animal, he will spend more on market purchases, possibly drive further distances or invest in guides and outfitters. The analysis of this tradeoff between market purchases, days spent hunting, miles travelled, and game harvested is important.

Each of the elements presented in the "production function" described above has a value. The consumer (hunter) observes the value of market purchases, travel costs, time spent and harvest and determines a bundle that minimizes cost while simultaneously maximizing utility from the activity of hunting. Substitutions between inputs in the production function will occur depending on the relative value changes. If the opportunity cost of time rises, the hunter will likely devote more to market purchases and spend less time hunting. If the probability of harvest goes down the hunter may increase his spending on guides or travel further distances. If the probability of harvest goes up the hunter may spend less time hunting[59]. This approach to wildlife consumption theory provides a theoretical basis for the evaluation of wildlife policy and the examination of future trends in wildlife allocation. It is a step beyond the extra-market benefit evaluation models since it includes supply factors and policy variables.

The relationships pointed out above can be observed through the analysis of correlation coefficients. Listed below are selected correlation coefficients for variables obtained from the sheep hunter selected sample.

1. Days - Compensation per day : -.6019
2. Days - Capital Cost per Day : -.1514
3. Days - Travel Cost per Day : -.1892
4. Days - Miles per Day: -.1191
5. Days - Harvest per Day: -.0422

The negative sign in front of each correlation coefficient points out the substitutability among characteristics. For example, the number of days spent is a substitute for the number of miles travelled per day or the travel cost per day. Also, as the opportunity cost of time (compensation per day) decreases, the number of days spent hunting increases. The use of these variables in an economic analysis will point out not only the relationships between the various characteristics of a hunting experience but also the relative magnitude of these relationships. This type of finding would be especially useful for policy formation. A household production function model that includes harvest, days of hunting, costs and the value of time would describe the tradeoffs between each of these characteristics. Bighorn sheep hunters for example would likely spend a great deal on capital purchases and increased hunting time in order to harvest an animal. Moose hunters on the other hand likely would not be spending as much and may be content to hunt with less probability of success. These are important policy factors. Even if licence fees are raised for certain types of hunting, harvest may continue at present levels because of substitution of inputs in the production function. While a complete analysis of these systems is beyond the scope of this study, a model has been presented which will aid policy makers. This model can be expanded to estimate production functions for days and harvest. The harvest production function would appear as:

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[59] The substitutability between hunting days and harvest has been pointed out in the demand curves for hunting days as discussed in the section on hedonic price valuation.

Harvest = f(Days, Expenditures, Miles Travelled)

This form of the harvest function would have the folowing implications. The dependant variable, being a zero-one variable, would not function as a normal dependant variable in a regression equation; rather, the coefficients of the independant variables would be interpreted as the increase in probability of harvest for a unit change in the dependant variable. Stated more clearly, this equation would indicate the increase in the probability of harvest for an additional mile travelled or an additional day spent hunting. This is analagous to the substitutability in the hunter's production function described above. This type of predicting equation would facilitate a closer connection between the demand for wildlife resources and the supply or stock of animals. This is the link between supply and demand which must be considered in policy analysis.

A second form of extension to this model would be an inclusion of the value of harvest as an addition to income in the full income constraint. This separation would allow harvest to be a "bonus" to the hunter. An analysis of this type would be able to compare the quantity of hunting (days, miles) with the quality of hunting (harvest). Again this is an important policy consideration. Will hunters travel further distances and spend more time to increase their hunting quality? The relationship between harvest, hunting quality and the economic demand for wildlife resource is essential for a thorough analysis of wildlife resources. Through the use of the household production function approach to consumer theory the role of economics in hunting activity has been clearly pointed out. The importance of including policy considerations in economic analysis has been illustrated and facilitated theoretically through the use of the household production function approach to wildlife demand.

E. Travel Cost Models

The most widely used method of recreation benefit estimation is the travel cost model. In this case several limiting assumptions had to be made in order to utilize the travel cost model. In particular, all hunting areas were assumed to be of equal quality and site characteristics. This assumption is very restrictive but in order to use the travel cost model on this data set it had to be employed. Since the travel cost model works only for particular sites its use is probably questionable for a large area. Nevertheless the estimates provided are interesting.

The travel cost model is essentially an equation that uses travel cost as the price variable and days of activity as the quantity variable. The consumer surplus under this demand function is estimated as the total extra–market benefit. For this study, the equation took the following form;

$$\ln TRCOST = f(\ln DAYS, \ln HARVEST, \ln INCOME, \ln EXPERIENCE)$$

This equation is the inverse demand function from which the consumer surplus can be estimated[60]. In this equation TRCOST is the travel cost per day of hunting activity. The results of these equations are presented in tables V.4 to V.8. In all cases the coefficient of the days variable is negative as expected and significantly different from zero at a 1% level (except for black bear).

Since the double log form of the inverse demand curve was utilized the inverse demand curve can be reduced into the following form;

$$\ln TRCOST = a + b \ln DAYS$$

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[60] The demand function that expresses days as a function of travel cost could have also been employed but the version used here provided better estimates and is theoretically sound

with the values of the shift variables evaluated at their means. The area under this curve can be estimated by the formula [61]:

$$\ln Area = \ln (antilog (a / (b+1)) + (b+1) \ln DAYS$$

The DAYS variable used in the evaluation of the integral is the average number of hunting days. The area given by the integral is the total area under the demand curve. In order to derive the consumer surplus the amount spent on the activity must be subtracted or the average travel cost per day times the average number of days must be subtracted. The estimates produced are average values of a day of hunting activity. These values are presented for each hunter group in table V.3.

The values of the travel cost model are considerably lower than the estimates for the average value of a day from the direct technique. This result is consistent with findings in the current literature. The travel cost model is generally quite conservative. However, the various estimates of value are not extremely dissimilar. The travel cost values for spring bear hunting are considerably higher than those of any other groups probably due to the higher travel costs per day (also presented in table V.3). Other than this discrepancy the heirarchy between sheep hunters and the other hunter groups is still apparent.

The discussion of the travel cost technique concludes the discussion of traditional measurement techniques. The next section is devoted to the discussion of the conclusions from this chapter on wildlife valuation and demand.

F. Empirical Conclusions

There have been many important points presented in this chapter. These points can be divided into three areas, the use of contingent valuation techniques, comparing valuation techniques and more general view of the wildlife resource sector through the household production model. Each area has relevance for future research and policy in the area of wildlife resources.

Firstly, the use of contingent valuation techniques or the direct method of estimating benefits seems to be a useful excercise especially to elicit values for use in benefit cost analysis and comparison of alternative resource use projects. The values determined here are comparable with other estimates of extra-market benefits and provide some insight into the scarcity of our recreation resources. In particular, bighorn sheep hunters value hunting days more than hunters from other groups. This corresponds to the same heirarchy developed from the analysis of socioeconomic characteristics and expenditures on hunting activity. Resource managers must realize that even though the socioeconomic characteristics of hunters are similar there are definite differences in intensity between groups. This fact is particularly important for the selection of policies for these groups. The results of the direct technique also provide some solutions to the dilema of selecting willingness to pay or willingness to accept compensation as the measure of value. The results presented above suggest that estimating compensation on a per season basis approximates willingness to pay. The difference between WTP and WTAC may lie in the fact that WTP may be the marginal measure of compensation value which is generally thought of on a longer term scale. In any case, the similarity between these measures lends confidence to them both and to the accuracy of the estimation procedure. A final result of the direct estimation discussion is the apparent use of compensation per day estimates as a proxy for the opportunity cost of time spent hunting. This measure of time value allows for differences in hunting intensity and institutional rigidities in the labour market. Conceptually, the use of this form of measurment would appear superior as a measure of the opportunity cost of time in recreation activities. Finally, the magnitude values derived through the direct estimation procedure reflects the scarcity values of wildlife species in Alberta and the value of hunting as a recreation resource.

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[61] This integral can be estimated by raising the entire function to the power "e" and solving for the definite integral using the normal procedures for power functions.

While it is true that the extra-market values alone provide little information about the resource and its use, the magnitudes of these values must be recognized. Table V.10 illustrates the size of benefits received by hunters in Alberta. These annual values are several times larger than the management costs incurred by the provincial government in the provision and regulation of hunting activity. The overall importance of wildlife resources (from a consumptive standpoint alone) are clearly visible.

A comparison of the various extra-market benefit evaluation techniques reveals that none of the methods is perfect. The strong limiting assumptions of the travel cost technique are the most likely reason that the estimates of value from this approach are

Table V.10: Total Extramarket Benefit Per Season of Selected Alberta Hunter Groups, 1981

Species Hunted	Average WTP/Day	No. of Hunters[1]	Days per Hunter	Total Annual Value[2]
Bighorn Sheep	$73.00	2,300	17.42	$2.90 million
Moose	$72.00	54,500	11.50	$45.10 million
Grizzly Bear	$70.00	860	6.24	$00.40 million
Goat	$68.00	39	22.39	$00.06 million
Elk	$63.00	29,000	12.19	$22.20 million

[1] NOTE: This includes only the estimated number of hunters active in 1981.
[2] NOTE: Calculated by multiplying the average WTP (willingness to pay) by the average number of days spent hunting in 1981 times the number of active resident hunters for 1981. This applies only to the species listed and only for the year 1981.

quite conservative. The estimates from the hedonic price technique on the other hand are large and may be due to the assumption of the perfectly elastic supply of inputs into the recreation production function. The direct benefit estimates lie between these two and interestingly, in the case of compensation per season, follow the magnitude of total expenditures for each hunter group quite closely. This relationship adds confidence to the use of direct estimates in a household production function or hedonic price technique since both are based on total expenditures. The main conclusion that must emerge from the comparison of the various benefit estimation techniques is that they are not the "endall" to wildlife economics. The values derived cannot be accepted with full confidence. Instead of observing the magnitude of estimates alone, researchers and policy makers should observe the determinants of the models with equal importance. The fact that hunting days and harvest are substitutable is an important conclusion. Also, the fact that an institutional structure exists relating different hunter groups to different values and intensities of hunting is also an important result. While the values generated here may be utilized in the evaluation of alternative land uses or in benefit cost analysis, a study recreation demand and wildlife resource allocation must analyze the relationships discovered in the models and study how these relationships will affect resource use in the future.

The fourth section of the chapter contains a relatively theoretical discussion of the advantages of the household production model. The incorporation of congestion and the valuation of the opportunity cost of time is an asset that other estimation techniques cannot claim. Also, the incorporation of a harvest or supply element into the analysis of demand is an important factor for policy analysis. The tradeoffs between various "inputs" into the production of hunting activity by the consumer and the magnitude of these tradeoffs is important to wildlife management in the future. The household production approach allows the amalgamation of economic, biological and institutional considerations within a demand model or economic framework. These variables are also important for policy formulation, as are the extra-market benefit estimates.

This chapter combines the theoretical synthesis of chapter three with the data collected by the procedures outlined in chapter four. Many important relationsips and factors are presented. These relationships are not the conclusion of the analysis however. The data presented up to this point are quantitative. Qualitative data have also been collected and are important in the analysis of any problem. In the case of wildlife resources in particular, the analysis of qualitative data is necessary to understand the equity or value questions involved. The next chapter presents some of the qualitative considerations necessary for further analysis of the problem.

VI. Qualitative Analysis

The analysis of wildlife allocation up to this point is concerned with the demand for wildlife resources by consumptive users. This analysis has ignored issues other than the supply of and demand for wildlife. There are however several other important issues that must be treated. Included in these issues are questions of the use; potential use and viability of the guiding and outfitting industry in the province; the perceptions of wildlife resource use by consumptive users; the concerns of consumptive users and the tradeoff between consumptive and non-consumptive uses of wildlife. Hunters were asked to comment on guide use and to state whether they would consider using a guide and how much they would be willing to pay for a guide. Non-resident hunters who are forced to use a guide (or be accompanied by a relative who is a resident of the province) were asked to rate guiding services on their trips to Alberta. These data are qualitative in nature. The majority of facts in this section are derived from direct statements and comments provided by questionnaire respondents. The first section presents findings on the use and potential use of guides. The second section contains a summary of the perception of wildlife resource use by hunters. The comments and concerns of hunters as reported in their responses to the questionnaire are presented in the third section. The final section draws conclusions about the qualitative analysis and relate these findings to the results presented in the previous chapters.

A. The Use and Potential Use of the Guiding and Outfitting Industry

The guiding and outfitting industry depends on the wildlife resource base for its livelihood. In particular, guides and outfitters depend on non-resident hunters as sources of income. Alberta hunting regulations require that non-resident hunters be accompanied by a guide or by a resident bearing a valid guide authorization licence. In general, resident hunters do not use guides. This industry would suffer greatly from a decline in hunting quality and, consequently, a decline in the influx of non-resident hunters. The wildlife resource, however, is owned by the people of Alberta thus; they should have first bid on its use according to traditional values. This situation is a value issue that involves resident hunters, non-resident hunters, guides, outfitters, legislators and wildlife management personnel. Chapter four pointed out that non-resident hunters spend up to $7,000 per season each and the majority of this amount is spent on guiding services. With increasing demand on the trophy species by residents, however, it is quite possible that the number of non-residents allowed to hunt may diminish either by direct quotas or by licence fee increases. The increasing pressure on the land base may reduce hunting quality and thus also reduce the number of non-resident hunters. The issue is complex. Nevertheless, information obtained by the survey may provide some insight into the problem and its solutions.

Each resident receiving the questionnaire was asked if he or she had ever used a guide in their hunting in Alberta. If the hunter had used a guide he or she was asked if a guide was used in 1981.[62] If the hunter had never used a guide in Alberta he or she was asked if consideration would be given to using guiding services. A comment section was included for those who wished to indicate why they would not consider using a guide in the future. Finally, respondents who specified that they would consider using a guide were asked how much they would be willing to pay for guiding services per day. Non-resident hunters were asked all of these questions; since most non-resident hunters presently use guides, they were asked to rate the guiding services that they received in 1981. The results are presented in tables VI.1 and VI.2.

Table VI.1 is a summary of the use and potential use of guiding statistics collected for resident hunters. Very few resident hunters have ever used guides, and even fewer used guiding services in the 1981 season. The potential use of guides has a somewhat different distribution. Approximately 20 to 30 percent of those hunters who have never used guides would consider using guides. In percentage form this figure seems low, but, in actual numbers this would mean a drastic increase in guiding services if these hunters actually engaged guides. The statistics presented also show that hunters in the eastern slopes group would be willing to pay more for the use of guiding services. The willingness to pay for guides indicated by eastern slopes hunters is not much less than the going market rate for guiding services (approximately $100 per day). This similarity between actual prices and the willingness to pay of resident hunters is an important finding. The hunters in the eastern slopes seem to be more likely to "rearrange" the inputs into the production of hunting in the direction of guided hunts. The discussion in the

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[62] Spring bear hunters were asked if they used a guide in the spring season.

Table VI.1: Use and Potential Use of Guides: 1981 Alberta Resident Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Percent That Have Ever Used a Guide	2.4	4.7	10	3.9	45.5	9.4	4.2	1.4	9.7	0.0
Percent That Used A Guide in 1981	0.0	2.3	4.5	0.0	0.0	0.0	0.0	0.0	3.9	0.0
Percent That Would Consider Using a Guide	23.7	23.9	24.0	21.1	18.8	29.0	23.7	22.5	18.7	22.7
Willingness To Pay for Guiding Services per Day	37.930	48.93	44.15	23.60	80.91	86.30	65.29	62.50	40.28	40.09
	(53.27)	(50.94)	(74.05)	(58.27)	(66.40)	(93.17)	(49.32)	(38.14)	(66.06)	(84.09)

[1] NOTE: Standard deviations are in parentheses.

Table VI.2: Use and Potential Use of Guides: 1981 Nonresident Hunters in Alberta

	Elk	Moose	Sheep	Grizzly	Black Bear
Percent That Have Ever Used a Guide	100	100	100	100	100
Percent That Used A Guide in 1981	85.0	92.4	100	100	92.9
Percent That Would Consider Using A Guide (if guide not used in 1981)	68.2	38.9	0.0	0.0	0.0
Willingness To Pay for Guiding Services	106.40 (92.02)	76.40 (44.92)	226.25 (147.27)	83.33 (28.87)	50.00 (52.03)
Rating of Guides (Percent for each rating)					
Very Good	48.6	39.0	62.0	33.0	38.5
Good	20.0	26.9	28.0	33.0	38.5
Fair	17.1	18.1	6.0	0.0	15.4
Poor	4.8	7.2	0.0	33.0	15.4
Very Poor	9.5	8.8	4.0	0.0	0.0
Mean Rating[1]	2.067	2.201	1.56	2.33	2.076

[1] NOTE: hunters were asked to rate their hunting guides on a 1 to 5 rating scale with 1 being excellent, 2 very good, 3 good, 4 poor and 5 very poor. The mean rating gives the average response for the hunter catagory. Thus a mean rating of 2.0 is a higher average rating than a mean of 2.75.

[2] NOTE: Stamdard deviation are in parentheses.

previous chapter showed that when one variable in the "production function" of the good (hunting in this case) rises, the conusmer substitutes other items. Guiding is one service that, although it has not been used in the past, may be used increasingly in the future. The willingness to pay for guiding services is markedly higher for bighorn sheep and goat hunter groups than it is for the other groups. The scarcity of these animals and the difficulty in capturing sheep or goats without a guide is probably responsible for these higher values. The "value of wildlife" component in the household production function presented in chapter four may be quite high for these species; thus, the use of guides to attempt to maximize utility, without incurring too high a cost, becomes a possibility.

Table VI.2 summarizes the non-resident statistics of guide use and rating of guides. Note that again sheep hunters have the highest willingness to pay for guiding services, followed by elk and grizzly bear hunters with moose and black bear hunters providing the lowest values. The order of these estimates corresponds roughly to the relative population number of the species of the wildlife species. Also, non-resident hunters are willing to pay more than resident hunters for guiding services. In rating their guides, sheep hunters found their guide to be of generally excellent quality. The other hunter groups gave guides a more varied rating but again in general guides were rated very highly. The difference between sheep guides and guides for other species is likely an institutional one. Sheep guides must possess a class A guiding licence. Guides for other species do not need this rating. The rating of guides by non-resident hunters may only confirm the fact that sheep guides or class A guides provide more complete hunting services than class B guides.

The analysis of the use and potential use of guiding by resident and non-resident hunters has pointed out some interesting facts. Firstly, there may be a potential for use of guides by resident hunters, particularly those who hunt in the eastern slopes region and those who hunt sheep and goat. Non-resident hunters have found that the quality of class A guides is high and thus would probably satisfy resident use as well. Non-residents, however are willing to pay more for guiding services; thus, are still likely to be the mainstay for the guiding industry of Alberta. The comments provided by resident and non-resident hunters were quite similar. Those resident hunters who did not use a guide and would not consider using a guide were asked to comment on why they did not consider the use of a guide. The answer in almost all cases was either "guides are too expensive" or "I don't need a guide because I know the area well enough". Several non-resident hunters complained about the mandatory use of guides required in Alberta. Others presented tales of misrepresentation by guides or poor treatment of their hunting parties. These comments by non-resident hunters were almost entirely concerned with class B guides. Not one sheep hunter complained about the guiding services; in fact, several wrote praises for the guide used. While it is difficult to come to a hard and fast conclusion about the use and potential use of the guiding industry in Alberta from this type of data, several trends have appeared. In particular, the potential use of class A sheep guides even by resident hunters seems quite promising. Before any conclusions are drawn, however, a short examination of the structure of the guiding industry and its institutional framework must be presented.

Guides in Alberta must qualify for an Alberta class A or class B guiding licence. Class B guides are generally utilized for moose, elk and other non-alpine species. Class A guides although also utilized for non-alpine species tend to specialize in sheep and goat hunting. Non-resident hunters often make use of the 21 outfitter groups that exist in the province. These outfitters provide guides as well as all of the other services necessary for the hunt. While a formalized system of allocating non-resident hunters to outfitters does not exist, non-resident sheep hunters are usually allocated to various outfitters based on the number of hunters tended to in the past five years.[63] Even with this allocation system however the outfitting industry appears to be suffering. There are no new outfitters entering the industry. Those outfitters who do not have trail riding as an optional income source suffer from the high cost of maintaining inventory and livestock and have generally low incomes.[64] The problem in the outfitting industry is shared by the guides who operate in the same areas. In general guides and outfitters must rely on sources of income other than guiding to maintain these services.

One technique for maintaining the viability of the guiding and outfitting industry is the implementation of "block guiding". This technique, utilized at present in British Columbia, makes the guide responsible for a certain area and restricts guiding by other individuals in this area. Essentially this process redefines property rights such that the guide becomes responsible for removal of game in the area. While this approach is appealing from an economic efficiency point of view, the political appeal of such a technique is lacking. In Alberta block guiding has been opposed by non-alpine class A guides because it would restrict their ability to guide in alpine areas.

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[63] This and much of the following information is from personal communication with C.G. Campbell, Fish and Wildlife Division, Alberta Energy and Natural Resources.
[64] C.G. Campbell, *op. cit.*.

The biological nature of the resource must also be considered as to how it relates to hunting pressure and guiding operations. One of the complaints by resident hunters is the perception on their part that guided non-resident hunts remove all of the prime trophy animals and leave few for resident who cannot afford guided hunts. "Observing the populations of sheep and goats in the eastern slopes region, we find that the total number of sheep in Alberta is approximately 5,000 (with about 1,000 of these in the national parks), and the total number of goats around 1,200. The maximum harvest for trophy animals of these species has been estimated at around 5 percent per year. These data indicate that a harvest of approximately 200 trophy sheep and 60 goats would be near the maximum allowable harvest.[65] The data collected by this survey estimates the trophy sheep harvest at 213 sheep and 28 goats (see Appendix B). While the harvest of goats is only about half of the estimated allowable harvest, the harvest of sheep is almost equal to the maximum allowable limit. One must consider that effects on a particular region or herd may be greater than the 10 percent guideline, especially for sheep. These figures indicate that the demand for these animals from a consumptive point of view has very nearly reached its maximum if the species is to be maintained at current levels. Geist[66] and Rutherford[67] point out that management of sheep has some pecularities in relation to the management of other game species. In particular they point out that sheep need to be managed on a "herd" basis instead of a total population basis and sheep are susceptable to periodic downturns in population due to lungworm infestation and pneumonia.

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[65] The harvest and population data presented here is from Wishart, W. 1978 *Species Management Plan for the Rocky Mountain Bighorn Sheep in Alberta*. Fish and Wildlife Division, Alberta Department of Energy and Natural Resources, and Hall, K.W. "Status and Management of the Rocky Mountain Goat in the Province of Alberta", in *Proceedings of the First International Mountain Goat Symposium* Kalispell, Montana. 1977.

[66] Geist, V. "Sheep Management Dilemmas", in *Transactions of the Northern Wild Sheep Council*, B.C. Fish and Wildlife Branch, Williams Lake, British Columbia. 1970.

[67] Rutherford, W.H. "Bighorn Sheep – What is Optimum Harvest ?", in *Transactions of the Northern Wild Sheep Council*, B.C. Fish and Wildlife Branch, Williams Lake, British Columbia. 1970.

The preceeding paragraph outlined some biological information on sheep and goat populations and their management. The economic objective of well defined property rights coincides with the biological objective of species management on a per herd basis. The management of sheep and goat populations on a "micro" level (small scale or herd level) is advocated by biological theory as well as the fact that harvestable numbers are being met by hunting activity. The economic objective of definite property rights could result from a micro level management technique in that herds could be managed for the appropriate level and type (age, sex, trophy or non-trophy) of harvest. While from a theoretical viewpoint these objective are fully compatible with these species, the practical objective may limit its use. Consider also that this synthesis of economic and biological objectives applies only to the two species discussed so far, sheep and goat. These animals lend themsleves to herd level management due to their biological community systems. Other species such as grizzly bear are more highly mobile and do not travel in groups. Elk and moose are very widely distributed in Alberta and for this reason are not candidates for micro level management. The interesting factor brought out by this analysis however is the notion that from the demand side sheep and goat hunters are different from other groups of hunters. Thus the difference in the socioeconomic aspects of the demand for these two species may facilitate the different biological management techniques required.

The apparent possibility for the creation of a link between supply and demand of two wildlife species, sheep and goat can be observed as follows. The actual mechanics of this link however are not clear. The guiding and outfitting industry may be the important link in this case. It may appear to be too costly (from a budgetary standpoint) for the Alberta government to place officers in the field to both manage these resources at a micro level as well as control the harvest of these animals. However, the possibility exists to employ guides and outfitters as the custodians for these regions. This policy would benefit the guiding industry as well as the management of these resources. At present, the government is reluctant to employ such a technique. The need for consideration of such an approach to wildlife management, however, has been indicated by the trend in the demand for wildlife. Undoubtedly, the opportunity cost of time spent on hunting will rise. The value of these game animals will also rise. The resident and non-resident bighorn sheep or mountain goat hunter will be willing to allocate more funds to market purchases in order to increase the probability of harvest and decrease the amount of time spent in hunting activity. These conclusions can be drawn from the household production model. Consider as well the socioeconomic data presented in chapters four and five. Sheep and goat hunters appear to be set apart from other groups of hunters in terms of amount of time and money spent in hunting activity. Sheep and goat hunters are also willing to pay more for guiding services. Their motivations are trophy oriented. While non-resident hunters are willing to pay higher amounts for guiding services the apparent excess capacity in the guiding and outfitting industry indicates that resident hunters may be able to receive guiding services at a rate somewhat lower than non-residents for a different package of services. The political lobby against such measures will be strong especially from resident hunters, but from an economic and management viewpoint a block guiding type of system has many merits. The block guiding system is one important policy issue that may become more important as the demand for trophy species increases.

B. Perceptions of Wildlife Resource Use

Respondent were asked to specify whether they thought wildlife resource use in Alberta was "excessive", "adequate" or "underutilized". Spring bear survey respondents were asked to indicate firstly if they felt grizzly bear wildlife resource use was excessive, adequate or underutilized and secondly if they felt that black bear wildlife resource use was excessive, adequate or underutilized. The results of these questions are presented in tables VI.3 (for resident hunters) and VI.4 (for non-resident hunters). Note that the responses for grizzly and black bear hunters are presented in two catagories with each group specifying their perceptions of grizzly and black bear resource use.

The results of the survey questions show that the majority of hunters feel that wildlife resource use is adequate in Alberta. The number of hunters that feel that resource use in excessive (between 15 and 20 percent for most hunter groups) is almost balanced by the number of hunters who feel that the resource is underutilized. No significant difference was apparent between the perceptions of eastern slopes hunters and those of all hunters. More non-residents viewed resource use as adequate than did residents; thus, fewer non-residents perceived underutilization or excessive use problems in Alberta. The

Table VI.3: Wildlife Resource Use Concerns: 1981 Alberta Resident Big Game Hunters

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly[1]	Black Bear[1]
Excessive Wildlife Resource Use (%)	17.4	19.2	10.7 (5.1)	16.95 (8.6)	21.1	21.7	17.5	12.5	14.3 (5.4)	5.35 (15.0)
Adequate Wildlife Resource Use (%)	68.9	66.8	72.7 (76.5)	61.5 (59.2)	63.2	59.2	69.8	75.0	66.0 (78.2)	65.0 (65.0)
Underutilized Wildlife Resource (%)	13.7	14.0	16.6 (18.4)	21.5 (12.9)	15.8	19.1	12.7	12.5	19.7 (16.3)	36.8 (20.0)

[1] NOTE: Grizzly Bear and Black Bear Survey Respondents were asked to rate wildlife resource use in terms of Grizzly Bear resource use and black bear resource use. The ratings for grizzly bear resource use are presented first and the rating for black bear resource use are presented in parenthesis.

Table VI.4: Wildlife Resource Use Concerns: 1981 Nonresident Big Game Hunters in Alberta

	Sheep	Elk	Moose	Grizzly[1]	Black[1]
Excessive Wildlife Resource Use (%)	11.8	6.80	15.9	0.00 (33.0)	33.0 (7.10)
Adequate Wildlife Resource Use (%)	80.9	86.1	79.5	66.7 (66.7)	50.0 (78.6)
Underutilized Wildlife Resource Use (%)	7.30	7.20	4.50	33.3 (0.00)	16.7 (14.3)

[1] NOTE: Grizzly Bear and Black Bear Survey Respondents were asked to rate wildlife resource use in terms of Grizzly Bear resource use and black bear resource use. The ratings for grizzly bear resource use are presented first and the rating for black bear resource use are presented in parenthesis.

results of this section, in themselves, are not much of an indication of the concerns of resident and non-resident hunters. The information provided by survey respondents in the form of comments and suggestions sheds a great deal more light on the question of what concerns do hunters have about the resource base and hunting activity.

C. Comments Provided by Survey Respondents

While not all of the comments provided by the respondents to the 1981 spring bear and 1981 big game hunting surveys can be discussed here, some of the recurring concerns stated by hunters are be presented. Four major types of concerns were specified by resident and non-resident hunters (although non-resident hunters seldom commented on hunting in Alberta): education of hunters, problems with hunting for males of species, a lack of regulation of hunting activity and, native hunting rights. Under the concern about hunter education, many respondents pointed out that they were concerned about the lack of hunting experience and understanding shown by other hunters. They advocated a compusory hunter training course or that a procedure somewhat similar to obtaining a drivers licence be used to obtain a hunting licence. Many related this concern to the urbanization of Alberta's population and the fact thay they are removed from wilderness areas. The second area of concern, hunting for males of a species, was expressed by many hunters as a potential problem for future hunting stocks. Hunters reported seeing herds with abnormally low levels of males and many commented that better management techniques would attempt to even out this difference, possibly by allowing a greater number of females to be harvested. The third concern related by many respondents, the question of adequate regulation, is closely related to the concern about hunter training. Many hunters commented that greater regulation is required in order to prevent misuse of the wildlife resource. Most feel that it is the government's responsibility to improve enforcement of hunting regulations. As well, many hunters pointed out that regulations and fines should be stiffer in many cases. In particular, several respondents were concerned with the use of off road vehicles, shooting of game out of season and alcohol use while hunting. The final major concern is again related to the issue of regulation and misuse of wildlife. A great number of respondents complained about the misuse of hunting rights granted to native people. Many presented examples of this misuse.

While the above has been a brief overview of the comments provided by hunters, and it is unlikely that completely certain results can be pointed out, one fact does appear frequently. Hunters are concerned about the use and misuse of wildlife resources. Many advocate better regulations, higher penalties, and better enforcement. These concerns about regulation and resource misuse can be related to the problem at hand through the theory of externalities and property rights. The misuse of wildlife resources is an external diseconomy imposed on the people who own the resource. The theory of property rights presented in chapter two points out that property rights (which would result in better enforcement of hunting regulations) evolve when the cost of enforcing the property rights is less than the cost of the externality. While the complete enforcement of hunting regulations in the province would only be possible under prohibitive cost conditions, the comments provided by hunters clearly show that the costs of hunting externalities are increasing and the movement towards more completely defined property rights is being advocated. This link between property, externalities and hunter perceptions is a situation which again points out the relevance of the economic theory of property rights in wildlife management.

D. Conclusions of the Qualitative Analysis

This chapter has provided a connection (although not a perfectly clear one) between the theory of property rights and wildlife management in Alberta. The section containing a discussion of the use and potential use of guiding and outfitting services emphasizes the particular biological features of the bighorn sheep and mountain goat game animals, the relation of these biological features with the guiding and outfitting industry and the emergence of a more definite system of property rights for these scarce resources. Sheep and goat resources are particularly well suited to the imposition of a system of property rights due to the differences in demands for these species and the differences in biological management techniques required. Guiding services for these species were rated very highly; thus, it is possible that the guiding and outfitting industry may play a part in the property institution. In particular, a system which allowed management of sheep and goats on a small scale, both for the maintenence of the population and the maximization of hunting benefits would result in better utilization of the resource and solve the problem of poorly defined property rights. The use of guides and outfitters in this program would solve some of the equity issues involved with this industry especially if resident hunters found guides as a useful alternative to other market purchases.

The government of Alberta has other options besides utilizing the guides and outfitters as a method of strengthening property rights. In general, any method of more intensive, "micro" or "herd" oriented management would provide a more complete link between supply of and demand for the resource. These small scale management techniques must be implemented relatively quickly for species such as sheep and goats. Other big game animals such as moose and elk need not be managed on as small a scale as sheep and goats but the management of these species should also be on a regional basis. Moose and elk may be managed in the existing WMU framework. In any event, there are several options as to how the regulating agency can manage sheep and goat resources on a small scale.

While the section on perceptions of wildlife resource use provided no conclusive evidence about misuse of resources or requirements for additional regulation, the comments provided by respondents clearly pointed out that regulation and misuse of resources are two issues that are important to hunters. The relation between these concerns and the property rights problem is the fact that increasing concerns about resource use and external diseconomies result in stronger definitions of property rights. The conclusions from this chapter are that more clearly defined property rights are desired by hunters as well as by resource managers. The analysis has come full circle from the definition of the problem of indefinite and/or imbalanced property rights, through the analysis of socioeconomic characteristics of hunters and demands for wildlife resources to the point where property rights are again the main issue. The property rights problem is created essentially through poorly defined ownership and police power. Since there is no effective owner of wildlife resources (although the government claims ownership they cannot actually excercise any of their ownership rights without considerable difficulty) there is no control on the "production" of wildlife resources. If property was more clearly defined (in a system of more intensive management) wildlife stocks could be augmented in situations of short supply (either by decreases in hunting or by biological improvements). The signals provided by the demanders would indicate to the wildlife management personel if stocks should be added to or possibly decreased in order to maintain hunting benefits. The analysis of demand models in this thesis shows that increasing pressure may be placed on sheep and goat resources. These are the species that must be considered first in any management scheme that considers demand pressures in its supply control decisions. Just as a firm increases output when demand and price are high, management institutions must either increase stocks or be able to effectively control the harvest of these resources.

This analysis has considered both the statistical analysis and the economic theory to relate the property rights problem to the particular issues related to hunting in the eastern slopes region. The next chapter presents overall conclusions and policy implications as they relate to each section of this analysis.

VII. Summary and Conclusions

The conclusions of this study are actually conclusions in four major areas: methodology, economic analysis, empirical analysis and qualitative analysis. Although all of the sections are combined in this analysis, each section has important conclusions and observations for future research and policy analysis. For this reason conclusions from each section are presented separately.

The major conclusion of the methodological analysis is the importance of property rights and institutions and the inadequacy of present economic analysis in its problem solving role. Economic analysis is presently divided between biological "supply side" models and demand side models. The former are essentially bioeconomic models that are based on restrictive assumptions and rely on known prices or relative values. The latter are based on demand theory and involve attempts to value the resource. The use of demand models for valuation while providing a basis for comparison between wildlife resource values and other resource use values does not provide a basis for the allocation of wildlife resources. The supply side models incorporate the biological factors into economic analysis but do not consider the institutions or uncertainties associated with the wildlife resource field. In particular, supply side models consider only extreme cases of full property rights or cases of unowned resources. Thus, neither economic technique solves the problem of indefinite or imbalanced property rights. Economic analyses of wildlife resources must include consideration of institutions and property rights. Valuation, demand prediction and supply analysis are all important but the problem is related to property institutions. Present economic analysis in this area does not generally incorporate theories of property rights. This analysis, because of the findings in the chapter on methodology, continually refers to the property rights problem and each section relates back to this crucial question.

This analysis, however, is not an institutional analysis. It recognizes the importance of institutions in the analysis of wildlife resources and refers to the issue of property rights frequently. This analysis examines the economic behavior of big game hunters and relates this economic behavior to property rights and policy. The major portion of this thesis is spent on economic analysis and only the latter sections are devoted to policy. Nevertheless, the economic and property institutions fundamental to the use of wildlife resources are instrumental in determining appropriate policy recommendations. A full institutional analysis would involve much more than has been presented here.

The second stage of inquiry as pointed out in the methodology is deductive analysis, the analysis of economic theory as it relates to wildlife resources. Chapter three contains an outline of the major economic techniqes used in the analysis of wildlife resources. The most important point within this section is the fact that the extra-market benefit techniques, while they are becoming more sophisticated and hopefully more accurate, are not the only aspect that needs to be considered in economic analysis. The values provided by these techniques do provide useful information but other useful economic information must also be provided to facilitate a complete analysis. The analysis of the determinants of demand are just as important as the values provided by the valuation techniques. The institutions involved in use of wildlife resources and predictions about change within these institutions is also important. The incorporation of policy variables in the economic analysis is very important. For this reason a new approach to the analysis of wildlife demand, the household production theory, is brought forth as a useful and flexible technique in the analysis of wildlife resources. Household production function models analyze recreation activity and include consideration of congestion effects, the opportunity cost of time, the effect of harvest of animals and other factors not usually considered in demand models or valuation techniques. The household production approach allows the analysis of the supply and demand side together as well as the analysis of policy variables in an economic framework. The inclusion of policy variables in economic theory is an important step in the field of wildlife resource economics. The household production function model presented here outlines only a few of the capabilities of this framework in the analysis of resource allocation. Nevertheless, the applicability of the household production function to wildlife resource analysis is a significant finding.

In order to form hypotheses about the problem situation, the economic theory presented in chapter three must be applied to actual data. These data were obtained from mail out questionnaires. A total of 1,773 resident hunters and 640 non-resident hunters responded to the questionnaire for a grand total of 2,411 respondents. Approximately 52% of the total resident survey respondents hunted in the eastern slopes region. The results of the questionnaire responses are presented in chapter four as well as in Appendix B. These results point out some interesting trends and factors. For example, even though there are only slight differences between the various groups of hunters (i.e. sheep, moose, elk etc.) there are very definite differences in the intensity of their hunting activity. Sheep hunters and goat hunters spend more money, take more hunting trips, are motivated more by trophy hunting and have higher willingness to pay values in general than all of the other groups of hunters. A heirarchy of hunting intensity can be developed based on these results and this heirarchy follows the relative scarcity of the wildlife species. This fact is the first link between the supply of and demand for wildlife species. The relationship between the scarcity of the species and the intensity of demand has been indicated by the analysis of the various hunter groups. The economic analysis presented here reveals that present management practices which manage wildlife resources more intensively as the species population becomes relatively lower (eg. goats are managed more intensively than moose) correspond with the management policies suggested by economic rationale. The intensity of demand by specific hunter groups corresponds to the relative population size of the wildlife species.

There are also similar differences in intensity within hunter groups, between those who engaged in hunting in the eastern slopes and the total sample. The eastern slopes hunters are also more intense. This result indicates that the eastern slopes region should also be managed more intensely than the province as a whole.

Several other interesting factors have been discovered in the analysis of the survey responses. Firstly, most hunters are primarily individuals who grew up in rural areas or small towns. As urbanization continues the demand for consumptive use of wildlife may decrease. However, the analysis of hunter motivations shows that hunters raised in rural areas hunt mainly for meat while hunters who grew up in urban environments hunt more for trophies. Also, those hunting for the trophy species (sheep, goat, grizzly bear) have fewer years of experience than those hunting for meat. While these are not entirely conclusive relationships, there may be some relationship between urbanization and trophy hunting which would result in a decline in demand for hunting of such species as moose and a rise in the demand for such species as sheep and goat.

The second use of the data collected is the application to economic models. The first technique utilized to estimate extra-market benefits was the direct approach. This yielded values ranging between $73.00 per day and $63.00 per day using the willingness to pay approach. Two facts about the direct extra-market benefit estimates are interesting. Firstly, the heirarchy between hunter groups is again pointed out by the compensation value estimate. Sheep and goat hunter values are higher than values for other hunter groups and eastern slopes hunters typically exhibit higher values than the total provincial hunter sample. In order to further analyze the extra-market benefit evaluation, a sample of the collected survey responses was extracted in which every observation had a complete set of responses for the variables necessary to perform all of the extra-market benefit calculations. Of the several calculations performed, the hedonic price estimates were the largest and the travel cost estimates were the smallest. The relationships between the various estimates are interesting. Compensation demanded per season followed the same trend as average expenditures per season. The average value of a day using the compensation value measure or the willingness to pay value measure are quite similar. In fact, all of the average values are similar. This similarity between measures is the only method of testing the various techniques. There are no other guidelines. For this reason the direct approach of benefit estimation has greater appeal than the other approaches because of its results, its flexibility and its lack of restricitive assumptions. The similarity of the results of the two forms lends confidence to the technique.

While extra-market values do not represent the end of the analysis they do have some particular uses. They are useful for benefit cost analysis or for the analysis of alternative uses of wildlife habitat. As an example of the magnitude of these benefit estimates, Table V.10 presents the total value of extra-market benefits for these selected wildlife species for the 1981 season. These values indicate the importance of the consumptive use of wildlife in the Province of Alberta.

The values derived are not the answers to the property rights problem however. While they are useful for certain purposes, they cannot provide the connection between the supply and demand of wildlife resources. For a better application of economic theory to this problem, a different technique, the household production function approach to consumer theory, is utilized. The shadow prices presented are only simple estimates of the opportunity cost of hunting activity. While this is not an extra-market benefit estimate it is a method of signifying the importance of hunting activity. The shadow prices presented for eastern slopes hunters in Table IV.9 again show the heirarchy between hunters of various species of game animals. If the spring bear hunters are excluded we find that sheep and goat hunters again have the highest values although in this case elk hunters have shadow prices very similar to sheep hunters. This analysis of shadow prices can be extended to include such effects as congestion and the supply of wildlife. A relatively theoretical section of chapter five points out the relationship between harvest and the other variables in the shadow price. In particular, sustitutions occur between inputs in the hunter's utility function. A relationship between the probability of harvest and the substitution of market purchases to increase this probability is discussed. In particular, the use of policy variables such as those that affect harvest (licence fees, season lengths, bag limits) can be analyzed in a household production function framework. The relationships between the use of various inputs and the demand for harvest of wildlife species illustrate that, in cases such as sheep and goat hunters, the demand for harvest may be strong enough for the consumer to susbstitute increasing market purchases or travel further distances in order to successfully harvest an animal. The theory for an analysis of the relationships between market purchases, the opportunity cost of time, travel distances and harvest was presented and some empirical evidence of these relationships is provided in chapter five. The household production function approach to wildlife resource allocation seems promising because of it applicability to policy variables and its flexibility in describing consumer demand.

The final section of the study contains the qualitative data obtained from survey respondents. Two general fields were to be investigated in this section, the use and potential use of guiding and outfitting services in the province and the perceptions of wildlife resource use by hunters. In terms of the use and potential use of guides, although few guides are used by residents, these guides, especially sheep guides, were rated very highly. There is some potential for the use of guides by resident hunters, especially sheep and goat hunters. Sheep and goat hunters are more intense in their hunting activity and they again are different than the other groups of hunters in the case of potential use of guides. Judging from the rating of guides provided by non-residents, sheep guides are also different than guides for other species in terms of quality of service. This fact leads to the notion that there is a potential for guide use by resident sheep and goat hunters.

Along with the information on the use and potential use of guides, the biological management situation for sheep and goats is presented. This presentation describes the suitability, from a wildlife management point of view, of developing a system of property rights for these species. Hunting pressure is near its maximum for sheep and goat and the imposition of a modified property rights system would lead to a better allocation of these scarce resources. The use of guides or block guiding techniques as a method of enforcing property rights is appealing from an economic and likely a biological standpoint although not necessarily from a political standpoint. If present trends continue, the substitutions within the production function for hunting activity may warrant controls of some sort for these two wildlife species. Consumptive users of sheep and goats are different than other users of wildlife and thus special policies relating to them must be considered. The use of guides as a method of more clearly defining property rights would be such a policy but other policies for more intense management of the resource may also reach the same goal.

An alternative to the use of block guiding as a system of improved property rights is a more intense management system for sheep and goats in the eastern slopes. Such a system would require monitoring of species population levels and administration of hunting permits on a "herd" or "micro" level. Such a system, although considerably more costly than present management of these species, is likely warrented by the high value of these resources to hunters and the increasing demands for these trophy animals. A system of lottery permits for specific areas could maximize hunter satisfaction while maintaining the species population above the critical zone. Such a management system may be more politically palatable and the equity issues concerning maintenence of the guiding and outfitting industry could be treated with other policies. A program in which resident hunters are encouraged to use guides and outfitters for sheep and goat hunts would be such a policy. In any case, the problem is one that is not easily solved due to its multiple objective nature.

The analysis of guide use reverts to the question of property rights. The analysis of the perceptions of wildlife resource use also has implications for the property rights problem. In general, the comments received from hunters are concerns about the lack of well defined rules, regulations and police power in the wildlife resource area. This indicates the need for more definite property rights. Institutions are formed by social processes and from the comments provided by respondents, more stringent property rights are desired by the hunting population. The return to the property rights issues suggests that the analysis gives way to the next stage (the final stage for this study) the presentation of hypotheses.

A study that concludes with the presentation of hypotheses may seem odd but in following an accurate methodological base, hypotheses are developed from the combination of deductive and inductive logic. These hypotheses are inferences about a population and must still be tested on the population and over time. The major hypotheses that evolve from this analysis are the following. A system of more clearly defined property rights for the allocation of bighorn sheep and goats may be facilitated through alterations in the guiding and outfitting institutions or through a more intense management scheme implemented by the Alberta Fish and Wildlife Division in the province which allow control over the supply and harvest of these wildlife resources. Increased regulation through lottery licencing systems and training programs will help reduce the effects of the property rights problem in the eastern slopes region for other species. The viability of the guiding and outfitting industry may be ensured through special packages for resident hunters, especially those hunters of sheep and goats. Wildlife resource managers must facilitate the desire amongst hunters for a clearer description of property rights. Whether this task is accomplished by the imposition of stricter regulation, mandatory hunter education or a strict lottery system of allocating hunting tags, wildlife managers must recognize the need for more clearly defined programs. Without change in these institutions, wildlife populations may suffer irreversible damage and resultant reduced human benefit from their existence. One suggestion that can be drawn from this hypothesis is that methods of small scale management should be studied by biologists and economists. This research is necessary to determine the best method of management for the incorporation of supply and demand effects in wildlife management. The block guiding technique should be subjected to this type of analysis to determine if it can be utilized as a management tool as well as a measure to distribute wealth and maintain employment in this sector. Further research must include economic analysis as well as biological analysis in order to follow trends in demand for different wildlife species. Socioeconomic characteristics can be misleading in demand analysis. Economic analysis should be developed on a species basis in order to capture the effects of differect hunter groups and their demand on wildlife resources.

Finally, hunters substitute input elements such as days, miles travelled, and market purchases in order to arrive at a desired level of utility from hunting activity. Therefore, policy makers can expect that changes in hunter expenditure and activity profiles will occur as harvest rates or hunting quality decrease. As hunting areas decrease in quality, hunters will travel further distances or invest in better equipment or spend more days hunting. The more intense groups of hunters (sheep and goat hunters or eastern slopes hunters) will be the first to change when these conditions occur. The implications of such a condition are that the remote populations of wildlife species will be attractive as hunting demand increases thus management of these herds will become much more of a priority than it has been in the past.

These hypotheses are only a few of the major considerations that have been brought forth throughout this analysis. However, the importance of the property rights in wildlife resources has been clearly outlined. Property institutions are changing and will continue to change, even for resources such as wildlife. These institutions will dictate future policy and regulation. If changes in social institutions are recognized before they cause political and social conflict, policy can be developed to avoid these costly and injurious conditions. This study has developed the basis for the role of economic analysis in wildlife resource allocation. While not all of the answers are embodied in this manuscript, the road towards a proper methodological analysis of wildlife resources has been presented, some conclusions about the state of "the economics of wildlife" and its application to resource policy have been stated and considerations for adjustment of future wildlife management policy have been presented.

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Appendix A

O.S. Longman Building
6909-116 Street
Edmonton, Alberta
T6H 4P2

Dear Hunter:

The Alberta Fish and Wildlife Division is responsible for the protection and management of Alberta's wildlife resources. In keeping with this responsibility, the Fish and Wildlife Division conducts periodic surveys (such as this one, which is in cooperation with the Department of Rural Economy, University of Alberta) to determine the extent of recreational activities related to wildlife resources. The information collected contributes to a greater understanding and more effective management of wildlife resources throughout Alberta.

We request your cooperation in completing, and returning, the enclosed questionnaire. To ensure that your individual responses are held in strict confidence, they will be combined with those of other respondents. It is not necessary to reveal your identity.

We hope you share in our objective of making wildlife management programs more responsive to the needs of present and future generations. Please take a few minutes and fill out the questionnaire and tell us your concerns about Alberta's wildlife resources. Your anticipated cooperation and assistance are greatly appreciated.

Sincerely,

Ron Weatherill
Director of Wildlife

O.S. Longman Building
6909-116 Street
Edmonton, Alberta
T6H 4P2

Dear Hunter:

Several weeks ago you were mailed a copy of the enclosed questionnaire and covering letter. If you have completed and returned the original questionnaire, please disregard the enclosed. We appreciate your assistance. If for some reason you have not completed and returned the questionnaire, we would be grateful if you would take a few minutes and complete the enclosed. We are anxious to receive as many returns as possible in order to ensure the success of this project.

Thanking you in advance.

Sincerely,

Ron Weatherill
Director of Wildlife

CONFIDENTIAL

ALBERTA SPRING BEAR HUNTING
RESIDENT SURVEY
1981 HUNTING SEASON

Residence (city or town)______________________

Age ____________________

Please indicate where you spent the majority of your youth:

______ Rural Area (less than 1,000 population)

______ Town (1,000 to 10,000 population)

______ City (over 10,000 population)

Sex: Male ______ Female ______

Occupation _________________________

Including yourself, how many of your immediate family are living at your residence (please circle),

1 2 3 4 5 6 7 8 9

Approximately what was the total amount of money earned by you and your family in 1980?

Less than $5,000 ____
$5,001 - $10,000 ____
$10,001- $15,000 ____
$15,001- $20,000 ____
$20,001- $25,000 ____
$25,001-$30,000 ____
$30,001-$35,000 ____
$35,001-$40,000 ____
$40,001-$45,000 ____
$45,000-OR OVER ____

Education (please circle highest year completed)

Grade School 0 1 2 3 4 5 6 7 8 9
High School 10 11 12
University 1 2 3 4 5 6 7 8 9
Technical School 1 2 3 4

Please respond to each question below by checking the appropriate answer:

a. Have you ever hunted bear before the 1981 season? YES ____ NO ____

b. Have you ever hunted bear in Alberta before the 1981 season?

YES ____ NO ____

Please indicate the number of years of hunting experience you have had for the following catagories:

a. Big Game ___________

b. Bird Game ___________

What are the main reasons that you go hunting ?

Rank (1st, 2nd, etc.) the following items in order of importance;

a. For Meat ______

b. For a Trophy ______

c. For Outdoor Enjoyment ______

d. For Companionship ______

e. For Exercise ______

f. Other (please specify) ________________________

Which Alberta licenses did you hold in 1980-81 ?

☐ Bird Game

☐ Migratory Bird Game

☐ Mule Deer

☐ Whitetailed Deer

☐ Angling License

☐ Grizzly Bear

☐ Non-Trophy Sheep

☐ Trophy Sheep

☐ Moose

☐ Elk

☐ Caribou

☐ Black Bear (spring)

☐ Goat

☐ Black Bear (fall)

☐ Other (please specify) ________________________

Did you hunt Bear for sport at least once during the 1981 hunting season in Alberta (Spring or Grizzly Bear)

YES ____ If "YES" please complete the questions that follow.

NO ____ If "NO" please return this questionaire in the self addressed envelope that has been provided.

If you did hunt bear in the spring of 1981, please complete the following information for each hunting trip taken (NOTE: 1 full day of hunting is 4 or more hours in the activity).

Trip No. 1

Areas Hunted (town, landmark or WMU) ____________________________

Days Hunted in Area (estimate to nearest one half day) ______

Miles to Area __________ No. in Hunting Party __________

Game Hunted in the Area ____

Game Bagged by Yourself (type and number) ______________________

Trip No. 2

Areas Hunted ____

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in the Area ____

Game Bagged by Yourself ____

Trip No. 3

Areas Hunted ____

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in the Area ____

Game Bagged by Yourself ____

Trip No. 4

Areas Hunted ____

Days Hunted ______ Miles to Area ______ No.in Party ______

Game Hunted in the Area ____

Game Bagged by Yourself ____

Trip No. 5

Areas Hunted ____

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in the Area ____

Game Bagged by Yourself ____

Trip No. 6

Areas Hunted ____

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in the Area ____

Game Bagged by Yourself ____

Trip No. 7

Areas Hunted ____________________

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in Area ____________________

Game Bagged in Area ____________________

Based on your experience, how would you rate your hunting trips in Alberta in the spring of 1981? (check one)

☐ VERY GOOD ☐ GOOD ☐ FAIR ☐ POOR ☐ VERY POOR

Please estimate as best you can the amount of money you personally spent for bear hunting in Alberta, in the spring season, 1981. Please estimate for each catagory as it applies to you.

a. Travel Costs $__________

(includes gasoline, oil, air fare, etc.)

b. Lodging $__________

(includes hotels, motels, camping fees, etc.)

c. Food $__________

(includes restaurant meals, food purchased for camping, etc.)

d. Beverages $__________

e. Rentals $__________

(includes rental of hunting equipment)

f. Guides $__________

(includes guiding fees, etc.)

g. Ammunition $__________

h. Hunting Services $__________

(includes packer fees, taxidermy, etc.)

i. Other $__________

(please specify)____________________

If you made any major purchases for hunting bear in the spring in Alberta (in 1981), that are used in whole or in part for hunting in Alberta, please list the item, the purchase price and the extent to which this item is used for bear hunting in Alberta.

a. ITEM__________________ PURCHASE PRICE __________________

Percentage of Time Item is Used for Alberta Bear Hunting in Spring (circle one)

2% 5% 10% 25% 50% 75% 100% OTHER______%

b. ITEM____________________ PURCHASE PRICE ____________________

Percentage of Time Item is Used for Alberta Bear Hunting in Spring

2% 5% 10% 25% 50% 75% 100% OTHER______%

c. ITEM____________________ PURCHASE PRICE ____________________

Percentage fo Time Item is Used for Alberta Bear Hunting in Spring

2% 5% 10% 25% 50% 75% 100% OTHER______%

If you participated in Bear hunting activities in Alberta, in the spring of 1981, how much value in **dollars per day** was it worth to you, above what you spent on travel and other expenses. (circle the appropriate value)

Average Dollar Value per Day

$ 5 10 15 20 25 30 35 40 45 50

$ 55 60 65 70 75 80 85 90 95 100

Higher or other dollar value (specify) $__________

Approximately how much money would you have to be paid not to hunt bear in either spring or fall (in Alberta) **for one year**. (Estimate and circle the least amount acceptable to you)

$ 0 1 2 3 4 5 6 7 8 9

$ 10 20 30 40 50 60 70 80 90

$ 100 200 300 400 500 600 700 800 900

If higher or other dollar value, please specify: $__________

Have you ever used a guide in your hunting in Alberta?

______ YES ______ NO

--If "yes", did you use one in the spring of 1981?

______ YES ______NO

--If "no", would you consider using a guide?

______ YES ______ NO

If you would not consider using a guide, please comment on why not

____

____

If you would consider using a guide, please state how much you would be willing to pay for guiding services per day.

$	10	20	30	40	50	60	70	80	90		
$	100	110	120	130	140	150	160	170	180	190	200

If higher or other, please specify: $__________

Do you feel that Black Bear use (as a wildlife resource) in Alberta is: (check one)

(a)Excessive______ (b)Adequate______ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems?

____

____

Do you feel that Grizzly Bear use (as a wildlife resource) in Alberta is:(check one)

(a)Excessive______ (b)Adequate______ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems?

____

____

Give any additional comments that might help evaluate bear hunting in Alberta.

____

____

____

CONFIDENTIAL

ALBERTA SPRING BEAR HUNTING
NONRESIDENT SURVEY
1981 HUNTING SEASON

1. Residence (city or town)__________________ (state or prov.)__________________
   (country)__________________
2. Age ________________
3. Please indicate where you spent the majority of your youth:
   ______ Rural Area (less than 1,000 population)
   ______ Town (1,000 to 10,000 population)
   ______ City (over 10,000 population)
4. Sex: Male ______ Female ______
5. Occupation ____________________
6. Including yourself, how many of your immediate family are living at your residence (please circle),
   1 2 3 4 5 6 7 8 9
7. Approximately what was the total amount of money earned by you and your family in 1980 ?(In Canadian Dollar Equivalents)

Less than $5,000 ____	$25,001-$30,000 ____
$5,001 - $10,000 ____	$30,001-$35,000 ____
$10,001- $15,000 ____	$35,001-$40,000 ____
$15,001- $20,000 ____	$40,001-$45,000 ____
$20,001- $25,000 ____	$45,000-OR OVER ____

8. Education (please circle highest year completed)

Grade School	0 1 2 3 4 5 6 7 8 9
High School	10 11 12
University	1 2 3 4 5 6 7 8 9
Technical School	1 2 3 4

9. Please respond to each question below by checking the appropriate answer:
   a. Have you ever hunted bear before the 1981 season ? YES ____ NO ____

b. Have you ever hunted bear in Alberta before the 1981 season ?

YES ____ NO ____

10. Please indicate the number of years of hunting experience that you have had for the following catagories:

a. Big Game __________

b. Bird Game __________

11. What are the main reasons that you go hunting ?

Rank (1st, 2nd, etc.) the following items in order of importance;

a. For Meat ______

b. For a Trophy ______

c. For Outdoor Enjoyment ______

d. For Companionship ______

e. For Exercise ______

f. Other (please specify) ____________________

12. Which Alberta licenses did you hold in 1980-81 ?

☐ Bird Game
☐ Migratory Bird Game
☐ Mule Deer
☐ Whitetailed Deer
☐ Angling License
☐ Grizzly Bear
☐ Non-Trophy Sheep
☐ Trophy Sheep
☐ Moose
☐ Elk
☐ Caribou
☐ Black Bear (spring)
☐ Goat
☐ Black Bear (fall)
☐ Other (please specify) ____________________

13. Did you hunt Bear for sport at least once during the 1981 hunting season in Alberta (Spring or Grizzly Bear)

YES ____ If "YES" please complete the questions that follow.

NO ____ If "NO" please return this questionaire in the self addressed envelope that has been provided.

14. Approximately what percentage of your **annual time spent sport hunting** did you spend hunting spring bear in Alberta in the 1980–1981 season ? (circle one)

100% 75% 50% 40% 30% 20% 10% 5% 1%

If other, please specify ______%

15. If you did hunt bear in the spring of 1981, please complete the following information for each hunting trip taken (NOTE: 1 full day of hunting is 4 or more hours in the activity).

Trip No. 1

Areas Hunted (town, landmark or WMU) ______________________

Days Hunted in Area (estimate to nearest one half day) ______

No. in Hunting Party ________

Game Hunted in the Area ______________________

Game Bagged by Yourself (type and number) ______________________

Trip No. 2

Areas Hunted ______________________

Days Hunted ______ No. in Party ______

Game Hunted in the Area ______________________

Game Bagged by Yourself ______________________

Trip No. 3

Areas Hunted ______________________

Days Hunted ______ No. in Party ______

Game Hunted in the Area ______________________

Game Bagged by Yourself ______________________

16. Was hunting the main purpose of your trip ? (If "NO", what was the main purpose ?)

a. 1st Trip: YES ______ NO ______ Main Purpose ______________

b. 2nd Trip: YES ______ NO ______ Main Purpose ______________

17. Based on your experience, how would you rate your hunting trips in Alberta in the spring of 1981? (check one)

☐ VERY GOOD ☐ GOOD ☐ FAIR ☐ POOR ☐ VERY POOR

18. Please estimate as best you can the amount of money you personally spent for bear hunting in Alberta, in the spring season, 1981. Please indicate **total trip expenditures** for all trips. (In Canadian Dollar Equivalents)

a. Travel Costs $__________

(includes gasoline, oil, air fare, etc.)

b. Lodging $__________

(includes hotels, motels, camping fees, etc.)

c. Food $__________

(includes restaurant meals, food purchased for camping, etc.)

d. Beverages $__________

e. Rentals $__________

(includes rental of hunting equipment)

f. Guides $__________

(includes guiding fees, etc.)

g. Ammunition $__________

h. Hunting Services $__________

(includes packer fees, taxidermy, etc.)

i. Other $__________

(please specify)____

19. Approximately how much of the above was spent in Alberta ?

a. Travel Costs $__________

b. Lodging $__________

c. Food $__________

d. Beverages $__________

e. Rentals $__________

f. Guides $__________

g. Ammunition $__________

h. Hunting Services $__________

i. Other $__________

20. If you participated in Bear hunting activities in Alberta, in the spring of 1981, how much value in **dollars per day** (in Canadian dollars) was it worth to you, above what you spent on travel and other expenses. (circle the appropriate value)

Average Dollar Value per Day

$ 5 10 15 20 25 30 35 40 45 50
$ 55 60 65 70 75 80 85 90 95 100

Higher or other dollar value (specify) $__________

21. Approximately how much money would you have to be paid (in Canadian dollars) not to hunt bear in either spring or fall (in Alberta) **for one year** . (Estimate and circle the least amount acceptable to you)

$ 0 1 2 3 4 5 6 7 8 9
$ 10 20 30 40 50 60 70 80 90
$ 100 200 300 400 500 600 700 800 900

If higher or other dollar value, please specify: $__________

22. Did you use a guide in your bear hunting in Alberta (spring 1981) ?

______ YES ______ NO

--If "yes",-- Based on your experience, how would you rate guiding services in the spring season in Alberta. (check one)

☐ VERY GOOD ☐ GOOD ☐ FAIR ☐ POOR ☐ VERY POOR

--If "no", would you consider using a guide?

______ YES ______ NO

If you would not consider using a guide, please comment on why not?

____

____

If you would consider using a guide, please state how much you would be willing to pay for guiding services per day.(in Canadian dollars)

$ 10 20 30 40 50 60 70 80 90
$ 100 110 120 130 140 150 160 170 180 190 200

If higher or other, please specify: $__________

23. Do you feel that Black Bear use (as a wildlife resource) in Alberta is: (check one)

(a)Excessive______ (b)Adequate__✓__ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems?

____

____

24. Do you feel that Grizzly Bear use (as a wildlife resource) in Alberta is: (check one)

(a)Excessive______ (b)Adequate______ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems ?

____

____

25. Give any additional comments that might help evaluate Bear hunting in Alberta.

____

____

____

E

CONFIDENTIAL

ALBERTA BIG GAME HUNTING
RESIDENT SURVEY
1981 HUNTING SEASON

1. Residence (nearest city or town)________________

2. Age ______________

3. Please indicate where you spent the majority of your youth:

   _____ Rural Area (less than 1,000 population)
   _____ Town (1,000 to 10,000 population)
   _____ City (over 10,000 population)

4. Sex: Male _____ Female _____

5. Occupation __________________

6. Including yourself, how many of your immediate family are living at your residence (please circle).

   1 2 3 4 5 6 7 8 9

7. Approximately what was the total amount of money earned by you and your family in 1981?

   Less than $5,000 ___
   $5,001 - $10,000 ___
   $10,001 - $15,000 ___
   $15,001 - $20,000 ___
   $20,001 - $25,000 ___
   $25,001-$30,000 ___
   $30,001-$35,000 ___
   $35,001-$40,000 ___
   $40,001-$45,000 ___
   $45,000-OR OVER ___

8. Education (please circle highest year completed)

   Grade School 0 1 2 3 4 5 6 7 8 9
   High School 10 11 12
   University 1 2 3 4 5 6 7 8 9
   Technical School 1 2 3 4

9. Please respond to each question below by checking the appropriate answer:

   a. Have you ever hunted big game before the 1981 season? YES ___ NO ___

   b. Have you ever hunted big game in Alberta before the 1981 season?
   YES ___ NO ___

10. Please indicate the number of years of hunting experience you have had for the following catagories:

a. Big Game ____________

b. Bird Game ____________

11. What are the main reasons that you go hunting ?

Rank (1st, 2nd, etc.) the following items in order of importance;

a. For Meat ______

b. For a Trophy ______

c. For Outdoor Enjoyment ______

d. For Companionship ______

e. For Exercise ______

f. Other (please specify) ________________________

12. Which Alberta licenses did you hold in 1981 ?

☐ Bird Game
☐ Migratory Bird Game
☐ Mule Deer
☐ Whitetailed Deer
☐ Angling License
☐ Grizzly Bear
☐ Non-Trophy Sheep
☐ Trophy Sheep
☐ Moose
☐ Elk
☐ Caribou
☐ Black Bear (spring)
☐ Goat
☐ Black Bear (fall)
☐ Other (please specify) ________________________

13. Did you hunt Big Game for sport at least once during the 1981 hunting season in Alberta

YES ____ If "YES" please complete the questions that follow.

NO ____ If "NO" please return this questionaire in the self addressed envelope that has been provided.

14. If you did hunt big game in 1981, please complete the following information for each hunting trip taken (NOTE: 1 full day of hunting is 4 or more hours in the activity).

Trip No. 1

Areas Hunted (town, landmark or WMU) ______________________

Days Hunted in Area (estimate to nearest one half day) _____

Miles to Area ________ No. in Hunting Party ________

Game Hunted in the Area ________________________________

Game Bagged by Yourself (type and number) __________________

Trip No. 2

Areas Hunted ____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area ________________________________

Game Bagged by Yourself _________________________________

Trip No. 3

Areas Hunted ____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area ________________________________

Game Bagged by Yourself _________________________________

Trip No. 4

Areas Hunted ____

Days Hunted _____ Miles to Area _____ No.in Party _____

Game Hunted in the Area ________________________________

Game Bagged by Yourself _________________________________

Trip No. 5

Areas Hunted ____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area ________________________________

Game Bagged by Yourself _________________________________

Trip No. 6

Areas Hunted ____

Days Hunted _____ Miles to Area _____ No. in Party _____

Game Hunted in the Area ________________________________

Game Bagged by Yourself _________________________________

Trip No. 7

Areas Hunted ____________________

Days Hunted ______ Miles to Area ______ No. in Party ______

Game Hunted in Area ____________________

Game Bagged in Area ____________________

15. Based on your experience, how would you rate your hunting trips in Alberta in 1981? (check one)

(__)VERY GOOD (__)GOOD (__)FAIR (__)POOR (__)VERY POOR

16. Please estimate as best you can the amount of money you personally spent for big game hunting in Alberta, in 1981. Please estimate for each catagory as it applies to you.

a. Travel Costs $__________

(includes gasoline, oil, air fare, etc.)

b. Lodging $__________

(includes hotels, motels, camping fees, etc.)

c. Food $__________

(includes restaurant meals, food purchased for camping, etc.)

d. Beverages $__________

e. Rentals $__________

(includes rental of hunting equipment)

f. Guides $__________

(includes guiding fees, etc.)

g. Ammunition $__________

h. Hunting Services $__________

(includes packer fees, taxidermy, etc.)

i. Other $__________

(please specify)____________________

17. If you made any major purchases for hunting big game in Alberta (in 1981), that are used in whole or in part for hunting in Alberta, please list the item, the purchase price and the extent to which this item is used for big game hunting in Alberta.

a. ITEM____________________ PURCHASE PRICE ____________________

Percentage of Time Item is Used for Alberta Big Game Hunting (circle one)

2% 5% 10% 25% 50% 75% 100% OTHER______%

b. ITEM____________________ PURCHASE PRICE ____________________

Percentage of Time Item is Used for Alberta Big Game Hunting

2% 5% 10% 25% 50% 75% 100% OTHER______%

c. ITEM____________________ PURCHASE PRICE ____________________

Percentage fo Time Item is Used for Alberta Big Game Hunting.

2% 5% 10% 25% 50% 75% 100% OTHER______%

18. If you participated in Big Game hunting activities in Alberta, in 1981, how much value in **dollars per day** was it worth to you, above what you spent on travel and other expenses. (circle the appropriate value)

Average Dollar Value per Day

$ 5 10 15 20 25 30 35 40 45 50

$ 55 60 65 70 75 80 85 90 95 100

Higher or other dollar value (specify) $__________

19. Approximately how much money would you have to be paid not to hunt big game in Alberta **for one year**. (Estimate and circle the least amount acceptable to you)

$ 0 1 2 3 4 5 6 7 8 9

$ 10 20 30 40 50 60 70 80 90

$ 100 200 300 400 500 600 700 800 900

If higher or other dollar value, please specify: $__________

20. Have you ever used a guide in your hunting in Alberta?

______ YES ______ NO

--If "yes", did you use one in the spring of 1981?

______ YES ______NO

--If "no", would you consider using a guide?

______ YES ______ NO

If you would not consider using a guide, please comment on why not.

____

____

If you would consider using a guide, please state how much you would be willing to pay for guiding services per day.

$ 10 20 30 40 50 60 70 80 90

$ 100 110 120 130 140 150 160 170 180 190 200

If higher or other, please specify: $__________

21. Do you feel that wildlife resource use in Alberta is: (check one)

(a)Excessive______ (b)Adequate______ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems?

____

____

22. Give any additional comments that might help evaluate big game hunting in Alberta.

____

____

____

E

CONFIDENTIAL

ALBERTA BIG GAME HUNTING
NONRESIDENT SURVEY
1981 HUNTING SEASON

1. Residence (nearest city or town)____________________

(state or prov.)____________________

(country)____________________

2. Age ____________________

3. Please indicate where you spent the majority of your youth:

______ Rural Area (less than 1,000 population)

______ Town (1,000 to 10,000 population)

______ City (over 10,000 population)

4. Sex: Male ______ Female ______

5. Occupation ______________________

6. Including yourself, how many of your immediate family are living at your residence (please circle),

1 2 3 4 5 6 7 8 9

7. Approximately what was the total amount of money earned by you and your family in 1981 ?(In Canadian Dollar Equivalents)

Less than $5,000 ____

$5,001 – $10,000 ____

$10,001– $15,000 ____

$15,001– $20,000 ____

$20,001– $25,000 ____

$25,001–$30,000 ____

$30,001–$35,000 ____

$35,001–$40,000 ____

$40,001–$45,000 ____

$45,000–OR OVER ____

8. Education (please circle highest year completed)

Grade School 0 1 2 3 4 5 6 7 8 9

High School 10 11 12

University 1 2 3 4 5 6 7 8 9

Technical School 1 2 3 4

9. Please respond to each question below by checking the appropriate answer:

   a. Have you ever hunted big game before the 1981 season ? YES ____ NO ____

   b. Have you ever hunted big game in Alberta before the 1981 season ?

   YES ____ NO ____

10. Please indicate the number of years of hunting experience that you have had for the following catagories:

    a. Big Game __________

    b. Bird Game __________

11. What are the main reasons that you go hunting ?

    Rank (1st, 2nd, etc.) the following items in order of importance;

    a. For Meat ______

    b. For a Trophy ______

    c. For Outdoor Enjoyment ______

    d. For Companionship ______

    e. For Exercise ______

    f. Other (please specify) ______________________

12. Which Alberta licenses did you hold in 1981 ?

    ☐ Bird Game
    ☐ Migratory Bird Game
    ☐ Mule Deer
    ☐ Whitetailed Deer
    ☐ Angling License
    ☐ Grizzly Bear
    ☐ Non-Trophy Sheep
    ☐ Trophy Sheep
    ☐ Moose
    ☐ Elk
    ☐ Caribou
    ☐ Black Bear (spring)
    ☐ Goat
    ☐ Black Bear (fall)
    ☐ Other (please specify) ______________________

13. Did you hunt Big Game for sport at least once during the 1981 hunting season in Alberta

    YES ____ If "YES" please complete the questions that follow.

    NO ____ If "NO" please return this questionaire in the self addressed envelope that has been provided.

14. Approximately what percentage of your **annual time spent sport hunting** did you spend hunting big game in Alberta in the 1981 season ? (circle one)

100% 75% 50% 40% 30% 20% 10% 5% 1%

If other, please specify ______%

15. If you did hunt big game in 1981, please complete the following information for each hunting trip taken (NOTE: 1 full day of hunting is 4 or more hours in the activity).

Trip No. 1

Areas Hunted (town, landmark or WMU) ______________________

Days Hunted in Area (estimate to nearest one half day) ______

No. in Hunting Party __________

Game Hunted in the Area ______________________________

Game Bagged by Yourself (type and number) __________________

Trip No. 2

Areas Hunted ______________________________________

Days Hunted ______ No. in Party ______

Game Hunted in the Area ______________________________

Game Bagged by Yourself ______________________________

Trip No. 3

Areas Hunted ______________________________________

Days Hunted ______ No. in Party ______

Game Hunted in the Area ______________________________

Game Bagged by Yourself ______________________________

16. Was hunting the main purpose of your trip ? (If "NO", what was the main purpose ?)

a. 1st Trip: YES ______ NO ______ Main Purpose ____________

b. 2nd Trip: YES ______ NO ______ Main Purpose ____________

17. Based on your experience, how would you rate your hunting trips in Alberta in 1981? (check one)

☐VERY GOOD ☐GOOD ☐FAIR ☐POOR ☐VERY POOR

18. Please estimate as best you can the amount of money you personally spent for big game hunting in Alberta, in 1981. Please indicate **total trip expenditures** for all trips. (In Canadian Dollar Equivalents)

a. Travel Costs $__________

(includes gasoline, oil, air fare, etc.)

b. Lodging $__________

(includes hotels, motels, camping fees, etc.)

c. Food $__________

(includes restaurant meals, food purchased for camping, etc.)

d. Beverages $__________

e. Rentals $__________

(includes rental of hunting equipment)

f. Guides $__________

(includes guiding fees, etc.)

g. Ammunition $__________

h. Hunting Services $__________

(includes packer fees, taxidermy, etc.)

i. Other $__________

(please specify)____

19. Approximately how much of the above was spent in Alberta ?

a. Travel Costs $__________

b. Lodging $__________

c. Food $__________

d. Beverages $__________

e. Rentals $__________

f. Guides $__________

g. Ammunition $__________

h. Hunting Services $__________

i. Other $__________

20. If you participated in Big Game hunting activities in Alberta, in 1981, how much value in **dollars per day** (in Canadian dollars) was it worth to you, above what you spent on travel and other expenses. (circle the appropriate value)

Average Dollar Value per Day

$ 5 10 15 20 25 30 35 40 45 50
$ 55 60 65 70 75 80 85 90 95 100

Higher or other dollar value (specify) $__________

21. Approximately how much money would you have to be paid (in Canadian dollars) not to hunt big game in Alberta **for one year** . (Estimate and circle the least amount acceptable to you)

$ 0 1 2 3 4 5 6 7 8 9
$ 10 20 30 40 50 60 70 80 90
$ 100 200 300 400 500 600 700 800 900

If higher or other dollar value, please specify: $__________

22. Did you use a guide in your hunting in Alberta.

______ YES ______ NO

--If "yes",-- Based on your experience, how would you rate guiding services in Alberta. (check one)

☐ VERY GOOD ☐ GOOD ☐ FAIR ☐ POOR ☐ VERY POOR

--If "no", would you consider using a guide?

______ YES ______ NO

If you would not consider using a guide, please comment on why not?

____

____

If you would consider using a guide, please state how much you would be willing to pay for guiding services per day.(in Canadian dollars)

$ 10 20 30 40 50 60 70 80 90
$ 100 110 120 130 140 150 160 170 180 190 200

If higher or other, please specify: $__________

23. Do you feel that wildlife resource use in Alberta is: (check one)

(a)Excessive______ (b)Adequate______ (c)Underutilized______

If you checked (a) or (c), what would you recommend as a solution to these problems?

____

____

24. Give any additional comments that might help evaluate Big Game hunting in Alberta.

____

____

____

Appendix B

Table B-1 Reasons for Hunting Given by Alberta Resident Sheep Survey Respondents, 1981

Reason for Hunting	Rank of Choice						Checked But	Not		Percent of Total
	1st	2nd	3rd	4th	5th	6th	Not Ranked	Ranked	Score**	Score
For outdoor enjoyment	313	133	55	8	1	0	50	18	2 914	28.9
For Meat	133	110	124	76	40	2	41	50	2 257	22.4
For Trophy	66	150	109	79	61	2	43	68	2 051	20.4
For Exercise	8	43	100	143	123	6	30	125	1 419	14.1
For Companionship	7	67	77	111	126	7	22	161	1 332	13.2
For Other Reasons	6	4	7	0	5	2	0	544	95	0.9

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-2 Reasons for Hunting Given by Alberta Resident Goat Survey Respondents, 1981

Reason for Hunting	Rank of Choice						Checked But Not Ranked	Not Ranked	Score**	Percent of Total Score
	1st	2nd	3rd	4th	5th	6th				
For outdoor enjoyment	13	6	4	1	0	0	0	2	127	26.4
For Meat	5	5	6	5	3	1	0	1	101	21.0
For Trophy	6	7	7	5	0	0	0	1	114	23.7
For Exercise	0	2	5	6	5	2	0	6	60	12.5
For Companionship	1	3	2	5	9	0	0	6	62	12.9
For Other Reasons	1	2	0	0	0	0	0	23	16	3.09

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-3 Reasons for Hunting Given by Alberta Resident Grizzly Bear Survey Respondents, 1981

	Number of License Holders									Percent
	Rank of Choice						Checked But	Not		of Total
Reason for Hunting	1st	2nd	3rd	4th	5th	6th	Not Ranked	Ranked	Score**	Score
For outdoor enjoyment	184	97	33	10	0	0	19	19	1 799	29.6
For Meat	101	90	66	32	21	0	20	32	1 508	24.8
For Trophy	39	73	78	52	37	4	13	66	1 178	19.4
For Exercise	3	30	68	67	73	2	9	110	812	13.4
For Companionship	3	30	42	77	72	1	5	132	725	11.9
For Other Reasons	4	1	3	2	3	5	0	344	58	0.9
	Eastern Slopes Hunters									
For outdoor enjoyment	94	32	12	4	0	0	6	7	799	30.1
For Meat	37	45	29	16	13	0	9	9	660	24.9
For Trophy	13	45	29	16	13	2	4	25	514	19.4
For Exercise	1	13	33	32	25	1	2	48	355	13.4
For Companionship	1	14	22	26	28	0	0	64	298	11.2
For Other Reasons	0	1	2	1	2	6	0	146	26	1.0

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-4 Reasons for Hunting Given by Alberta Resident Black Bear Survey Respondents, 1981

	Number of License Holders									Percent
	Rank of Choice						Checked But	Not		of Total
Reason for Hunting	1st	2nd	3rd	4th	5th	6th	Not Ranked	Ranked	Score**	Score
For outdoor enjoyment	118	62	11	2	0	1	15	27	1 112	29.7
For Meat	75	56	40	19	6	1	16	23	1 000	26.7
For Trophy	11	31	29	35	47	0	10	73	561	15.0
For Exercise	0	24	49	54	25	2	3	79	538	14.3
For Companionship	2	21	46	34	39	2	6	86	498	13.3
For Other Reasons	2	2	1	2	0	5	0	224	37	1.0
	Eastern Slopes Hunters									
For outdoor enjoyment	12	7	1	0	0	0	1	1	113.5	29.5
For Meat	6	6	3	4	1	0	1	1	94.5	24.6
For Trophy	1	4	3	6	3	0	1	4	64.5	16.8
For Exercise	0	0	5	4	6	1	1	5	47.5	12.3
For Companionship	1	10	6	2	5	0	1	5	56.5	14.7
For Other Reasons	0	10	0	0	0	0	0	21	8	2.1

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-5 Reasons for Hunting Given by Alberta Resident Elk Survey Respondents, 1981

	Number of License Holders									Percent
	Rank of Choice						Checked But	Not		of Total
Reason for Hunting	1st	2nd	3rd	4th	5th	6th	Not Ranked	Ranked	Score**	Score
For outdoor enjoyment	118	78	17	3	1	0	35	14	1 265	29.8
For Meat	93	51	44	18	6	0	34	20	1 140	26.9
For Trophy	12	21	28	30	60	2	18	95	546	12.9
For Exercise	2	33	59	55	26	0	21	70	683	16.1
For Companionship	1	25	46	16	33	0	18	95	570	13.4
For Other Reasons	2	4	1	1	0	1	0	257	40	0.9
	Eastern Slopes Hunters									
For outdoor enjoyment	71	37	13	3	1	0	14	5	709	29.6
For Meat	45	33	29	9	5	0	14	9	623	26.0
For Trophy	9	15	16	18	35	1	6	44	333	13.9
For Exercise	1	21	32	35	17	0	6	32	393	16.4
For Companionship	1	14	25	29	23	0	6	46	324	13.5
For Other Reasons	0	3	0	0	0	1	0	140	16	.70

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-6 Reasons for Hunting Given by Alberta Resident Moose Survey Respondents, 1981

Reason for Hunting	Number of License Holders									Percent of Total Score
	Rank of Choice						Checked But Not Ranked	Not Ranked	Score**	
	1st	2nd	3rd	4th	5th	6th				
For outdoor enjoyment	105	103	9	0	0	0	26	22	1 246	30.2
For Meat	126	49	32	20	5	0	22	11	1 254	30.4
For Trophy	4	11	26	32	67	2	0	123	415	10.1
For Exercise	3	24	79	33	32	0	8	86	637	15.5
For Companionship	1	27	45	60	13	1	6	112	543	13.2
For Other Reasons	2	1	2	0	2	0	0	258	29	0.7
	Eastern Slopes Hunters									
For outdoor enjoyment	41	32	4	0	0	0	6	1	392	31.2
For Meat	25	19	13	7	4	0	4	3	336	26.8
For Trophy	2	7	13	13	17	0	0	23	172	13.7
For Exercise	0	8	14	17	13	0	1	22	176	14.0
For Companionship	1	11	18	7	6	0	3	29	174	13.8
For Other Reasons	1	0	0	0	0	0	0	74	6	0.5

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-7 Reasons for Hunting Given by Nonresident Sheep Survey Respondents, Alberta 1981.

Reason for Hunting	Rank of Choice						Checked But Not Ranked	Not Ranked	Score**	Percent of Total Score
	1st	2nd	3rd	4th	5th	6th				
For outdoor enjoyment	23	20	3	0	0	0	6	0	265	32.7
For Meat	0	3	7	8	11	0	1	23	92	11.3
For Trophy	24	13	3	2	1	0	6	4	244	30.1
For Exercise	0	2	10	6	11	1	1	22	95	11.5
For Companionship	0	4	10	13	4	0	2	20	112	13.8
For Other Reasons	0	1	0	0	0	0	0	52	5	0.6

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-8 Reasons for Hunting Given by Nonresident Elk Survey Respondents, Alberta, 1981

Reason for Hunting	Rank of Choice 1st	2nd	3rd	4th	5th	6th	Checked But Not Ranked	Not Ranked	Score**	Percent of Total Score
For outdoor enjoyment	40	25	6	1	0	0	19	6	440	23.3
For Meat	9	20	28	20	13	1	14	32	388	20.6
For Trophy	24	32	22	13	5	2	11	28	471	24.9
For Exercise	0	8	20	18	30	1	8	52	255	13.5
For Companionship	2	21	18	22	13	0	7	54	299	15.8
For Other Reasons	2	1	3	1	1	0	0	129	34	1.8

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-9 Reasons for Hunting Given by Nonresident Moose Survey Respondents, Alberta, 1981

Reason for Hunting	Rank of Choice 1st	2nd	3rd	4th	5th	6th	Checked But Not Ranked	Not Ranked	Score**	Percent of Total Score
For outdoor enjoyment	124	51	12	1	0	0	40	17	1 450	30.5
For Meat	42	71	54	32	12	2	31	51	1 023	21.5
For Trophy	24	40	40	38	44	2	17	90	751	15.8
For Exercise	0	19	34	48	73	5	18	98	571	12.0
For Companionship	7	45	63	98	23	1	18	89	905	19.1
For Other Reasons	4	1	3	1	1	2	0	283	48	1.0

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-10 Reasons for Hunting Given by Nonresident Grizzly Bear Survey Respondents, Alberta, 1981

Reason for Hunting	Rank of Choice 1st	2nd	3rd	4th	5th	6th	Not Ranked	Score**	Percent of Total Score
For outdoor enjoyment	2	1	0	0	1	0	1	19	21.8
For Meat	0	1	3	1	0	0	0	20	23.0
For Trophy	2	2	0	0	0	0	1	22	25.3
For Exercise	0	0	1	1	1	0	2	9	10.3
For Companionship	0	1	0	1	1	1	1	11	12.7
For Other Reasons	1	0	0	0	0	0	4	6	6.9

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each license holder, on average, gave 4.2 reasons for hunting and each active hunter, on average, gave 5.3 reasons.

Table B-11 Reasons for Hunting Given by Nonresident Black Bear Survey Respondents, Alberta, 1981

	Rank of Choice						Checked But	Not		of Total
Reason for Hunting	1st	2nd	3rd	4th	5th	6th	Not Ranked	Ranked	Score**	Score
For outdoor enjoyment	78	19	13	0	0	0	11	8	643	31.2
For Meat	14	30	23	9	10	3	7	33	394	19.1
For Trophy	20	29	16	22	14	0	6	22	438	21.3
For Exercise	0	5	13	24	32	2	5	48	228	11.1
For Companionship	3	20	29	20	10	1	3	43	323	15.7
For Other Reasons	2	1	1	1	1	0	0	121	32	1.6

** The scores are weighted sums of the rankings in which "1st" is weighted 6, "2nd" 5, "3rd" 4, "4th" 3, "5th" 2, "6th" 1 and "Checked But Not Ranked" 2.5. Each respondent, on average, gave four reasons and in cases where no rankings were provided, each choice on average would rank between "2nd" and "3rd"; hence the weighting of 2.5 for entries under "Checked But Not Ranked".

Table B-12: Occupations of Alberta Resident Hunters, 1981 (percentage in each catagory)

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Professional	12.9	14.8	18.4	10.9	8.0	14.0	15.5	13.9	21.7	13.6
Managerial	6.7	7.0	7.5	9.6	4.0	7.0	7.0	8.3	4.6	4.5
Contractor	2.7	0.8	3.1	0.9	0.0	1.0	0.7	5.6	2.0	0.0
Farming	12.2	12.5	5.9	12.2	16.0	15.0	9.2	11.1	4.6	9.1
Tradesmen	15.3	18.3	22.3	25.7	20.0	18.0	19.0	11.1	22.4	31.8
Transportation	3.1	5.1	3.4	3.0	4.0	3.0	4.9	4.2	2.6	0.0
Service	8.6	7.4	9.8	10.4	24.0	11.0	8.5	12.5	11.2	18.2
Sales	3.1	4.7	3.6	2.6	4.0	4.0	5.6	2.8	3.3	4.5
Armed Forces	0.0	0.4	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Clerical	0.0	0.0	0.3	0.0	4.0	0.0	0.0	0.0	0.0	0.0
Labourers	26.3	21.4	22.3	17.8	12.0	17.0	21.1	26.4	24.3	18.2
Homemaker	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Student	2.0	2.7	2.0	3.0	0.0	5.0	2.8	0.0	2.0	0.0
Retired	2.4	2.7	1.4	2.6	0.0	1.0	2.1	2.8	1.3	0.0
Not in Labour force	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous	3.1	1.9	0.0	1.3	4.0	2.0	2.8	1.4	0.0	0.0

Table B-13 Occupations of Nonresident Hunters, Alberta 1981 (Percentage in Each Catagory).

	Sheep	Elk	Moose	Grizzly	Black
Professional	36.5	22.1	16.0	0.0	18.4
Managerial	7.7	7.4	9.0	40.0	20.0
Contractor	7.7	5.9	6.0	0.0	3.2
Farming	13.5	11.0	8.0	0.0	10.4
Tradesmen	1.9	8.1	11.0	40.0	12.0
Transportation	0.0	2.2	2.0	0.0	1.6
Service	7.7	7.4	10.0	20.0	9.6
Sales	3.8	8.8	4.0	0.0	4.8
Armed Forces	0.0	0.0	0.0	0.0	0.0
Clerical	0.0	0.0	0.0	0.0	0.0
Labourers	7.7	12.5	16.0	0.0	14.4
Homemaker	0.0	0.7	0.0	0.0	0.0
Student	1.9	0.7	0.0	0.0	0.0
Retired	3.8	8.1	9.0	0.0	5.6
Not in Labour Force	0.0	0.0	0.0	0.0	0.0
Miscellaneous	7.7	0.7	6.0	0.0	0.0

Table B-14 Origins of Sampled Nonresident Hunters, Alberta 1981

Sheep	Elk	Moose	Grizzly	Black
Canada (Non Albertans) 1.9 %	Canada 33.3 % -- Sask. 12% -- Ontario 10% -- B.C. 7%	Canada 15.9 % -- B.C. 5%	Canada 20.0 % -- Sask. 20.0%	Canada 10.1 %
U.S.A 94.3% -- Texas 25% -- Penn. 12% -- Calif. 8% -- Florida 6% -- Wyoming 6%	U.S.A. 63% -- Wash. 10% -- Penn. 8% -- Texas 8% -- Minn. 5%	U.S.A. 77.6% -- Wash. 33% -- Oregon 8% -- Calif. 7% -- N. Dak. 5%	U.S.A. 60% -- Col. 40% -- N.J. 20%	U.S.A. 65.9% -- Wash. 14.7%
Germany 1.9%	Germany 2.2%	Germany 2.4%	Switz. 20%	Germany 17.8%
Austria 1.9%	Italy 0.7%	Austria 0.7% Denmark 0.7% Sweden 0.7% Australia 0.3% Norway 0.3% Switz. 0.3%		Denmark 1.6% Sweden 1.6% Switz. 1.6% Austria 0.8% Norway 0.8%

Table B-15: Harvest Rates of Alberta Resident Hunters, 1981 (percentages)

	Total Active Hunters				Eastern Slopes Hunters					
	Moose	Elk	Grizzly	Black Bear	Goat	Sheep	Elk	Moose	Grizzly	Black Bear
Harvest/ Licence Holder	16.98	10.5	2.22	8.12	65.4	6.57	----	----	----	---
Harvest/ Active Hunter	21.33	11.8	2.49	25.3	70.8	7.04	15.28	24.0	3.87	18.18
Harvest/ Trip	10.39	6.45	----	---	89.47	5.26	6.45	11.0	2.47	9.30
Total Estimated Harvest	11,615	3,423	22	1,292	28	176	----	----	----	---

Table B-16 Harvest Rates of Nonresident Hunters (percentages), Alberta 1981.

	Sheep	Elk	Moose	Grizzly	Black
Harvest/ Licence Holder	49.05	10.22	35.93	20.00	4.00
Harvest/ Active Hunter	50.00	11.02	37.99	33.33	33.00
Harvest/ Trip	50.00	12.39	35.54	33.33	42.00
Total Estimated Harvest	37	32	553	7	18

Table B-17 Total Estimated Harvest, Alberta 1981.

Species	Resident Harvest	Nonresident Harvest	Total Harvest
Goat	28	----	28
Sheep	176	37	213
Elk	3,423	32	3,455
Moose	11,615	553	12,618
Grizzly (spring)	22	7	29
Black Bear (spring)	1,292	18	1,310

Table B-18 Hunting Activity (by species hunted) for Alberta Resident Sheep Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	58	52	.896
Cougar	3	0	0
Deer (unspecified)	356	22	.062
Mule Deer	443	134	.302
White Tailed Deer	316	128	.405
Elk	908	76	.084
Goat	9	5	.555
Moose	370	82	.222
Trophy Sheep	722	38	.053
Non Trophy Sheep	31	15	.484
Black Bear	226	26	.115
Grizzly Bear	14	1	.071

Table B-19 Hunting Activity (by species hunted) for Alberta Resident Goat Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	4	4	1.00
Cougar	----	----	---
Deer (unspecified)	14	1	.071
Mule Deer	13	4	.308
White Tailed Deer	14	8	.571
Elk	35	7	.200
Goat	19	17	.895
Moose	23	3	.130
Trophy Sheep	18	2	.111
Non Trophy Sheep	3	1	.333
Black Bear	9	3	.333
Grizzly Bear	2	0	.000

Table B-20 Hunting Activity (by species hunted) for Alberta Resident Moose Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	8	7	.875
Cougar	1	1	1.00
Deer (unspecified)	182	6	.033
Mule Deer	108	27	.250
White Tailed Deer	121	45	.372
Elk	177	6	.034
Goat	0	0	.000
Moose	433	45	.104
Trophy Sheep	16	1	.062
Non Trophy Sheep	1	0	.000
Black Bear	40	4	.100
Grizzly Bear	0	0	.000

Table B-21 Hunting Activity (by species hunted) for Alberta Resident Elk Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	12	11	.917
Cougar	0	0	.000
Deer (unspecified)	215	13	.060
Mule Deer	146	45	.308
White Tailed Deer	108	28	.259
Elk	434	28	.064
Goat	0	0	.000
Moose	304	52	.171
Trophy Sheep	26	1	.038
Non Trophy-Sheep	5	2	.400
Black Bear	63	5	.079
Grizzly Bear	1	0	.000

Table B-22 Hunting Activity (by species hunted) for Alberta Resident Eastern Slopes Moose Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	6	5	.83
Cougar	0	0	.000
Deer (unspecified)	74	2	.027
Mule Deer	53	16	.302
White Tailed Deer	37	16	.432
Elk	123	6	.049
Goat	0	0	.000
Moose	163	18	.110
Trophy Sheep	15	0	.000
Non Trophy Sheep	1	0	.000
Black Bear	28	2	.171
Grizzly Bear	0	0	.000

Table B-23 Hunting Activity (by species hunted) for Alberta Resident Eastern Slopes Elk Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Antelope	7	6	.857
Cougar	0	0	.000
Deer (unspecified)	135	7	.052
Mule Deer	113	32	.283
White Tailed Deer	76	18	.237
Elk	308	22	.071
Goat	0	0	.000
Moose	168	32	.190
Trophy Sheep	23	1	.043
Non Trophy Sheep	5	2	.400
Black Bear	48	4	.083
Grizzly Bear	1	0	.000

Table B-24 Hunting Activity (by species hunted) for Alberta Resident Spring Grizzly Bear Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Black Bear	365	101	.277
Grizzly Bear	308	8	.026

Table B-25 Hunting Activity (by species hunted) for Alberta Resident Spring Black Bear Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Black Bear	90	19	.211

Table B-26 Hunting Activity (by species hunted) for Alberta Resident Eastern Slopes Grizzly Bear Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Black Bear	297	46	.155
Grizzly Bear	243	6	.025

Table B-27 Hunting Activity (by species hunted) for Alberta Resident Eastern Slopes Spring Black Bear Hunters, 1981

Species Hunted	Trips	Harvest	Harvest per Trip
Black Bear	43	4	.093

Table B-28 Hunting Activty By Eastern Slopes WMU of Alberta Resident Goat Hunters, 1981.

WMU	Trips to WMU	Avg. No. of Days	Avg. Miles Travelled	Avg. Party Size.
300	1	1.0	15	3
304	5	3.0	75	2.6
316	1	1.0	50	1.0
340	6	3.17	133.3	2.67
342	1	4.0	000	4.0
346	1	3.0	180	2.0
352	1	1.0	150	3
354	1	8.0	70	3
356	1	2.0	550	3
400	4	2.75	65	2
402	1	2.0	140	2
406	2	5.0	35	1
420	2	3.5	120	3.3
429	1	5.0	250	5
430	2	3.0	175	2
438	3	6.3	120	3.3
439	2	2.5	250	2.5
440	4	4.5	377	3
442	11	7.0	419	3.4
444	8	4.62	137	3
446	1	3.0	15	2

Note: Trips to WMU indicates the number of trips to each by WMU by the survey respondents. Avg. No of Days indicates the average number of hunting days within each WMU estimated to the nearest half day. The Avg. Mile Travelled indicates the average distance to the hunting area in miles.

Table B-29 Game Hunted and Harvested by Eastern Slopes WMU, Alberta Resident Goat Hunters, 1981.

WMU	Antelope	Cougar	Deer Unsp.	Mule Deer	W.T. Deer	Elk	Goat	Moose	T. Sheep	N.T. Sheep	Bl. Bear	Gr. Bear
300				1/0	2/1							
304			2/1			5/1						
316			1/0									
340			1/0	1/0	1/0	5/2		2/0				
342						1/1						
346			1/0			1/0		1/0				
352								1/0				
354								1/0				
356								1/0				
400				1/1		2/1			1/0			
402				1/0		1/0						
406				1/0				1/1				
420						2/0						
429						1/0		1/0				
430						2/0						
438			1/0			1/0		1/0	2/0			
439							2/2					
440						1/0	1/1		3/1	1/1		
442						2/0	11/9	2/0	7/1	1/0	2/0	
444							4/4		3/0	1/0		
446								1/1				
TOTAL	0	0	5/1	5/1	2/1	24/5	18/16	12/2	16/2	3/1	2/0	0

Note: Deer Unsp indicates Deer unspecified, T. Sheep indicates Trophy Sheep while N.T. Sheep indicates Non Trophy Sheep. The game hunted / harvest statistics are presented in the form (number of trips hunted / number harvested). Thus a 11/9 under goat for a particular WMU indicates that there were 11 hunting trips for goat in that WMU and 9 goats were harvested.

Table B-30 Hunting Activty By Eastern Slopes WMU of Alberta Resident Sheep Hunters, 1981.

WMU	Trips to WMU	Avg. No. of Days	Avg. Miles Travelled	Avg. Party Size.
300	36	1.93	74.0	2.67
302	51	2.66	77.4	2.49
304	92	2.48	69.57	2.91
306	13	2.54	75	2.9267
308	44	2.45	83.71	2.92
310	23	2.52	59.27	2.13
312	43	2.08	54.90	2.86
316	10	2.80	72.60	2.40
318	12	2.42	97.67	2.5
324	9	3.33	58.11	2.44
326	1	5.0	170	2.0
328	15	3.2	98.27	2.40
330	9	4.05	76.11	2.0
339	1	2.0	40.0	4.0
340	16	4.03	98.21	1.94
342	3	3.00	115.0	4.33
344	11	2.80	51.36	2.00
346	10	2.89	128	n.a.
352	9	2.78	215	3.00
354	15	3.60	180	2.73
356	10	4.00	50.56	2.1
400	164	3.86	78.14	2.94
402	210	3.32	88.88	2.52
404	91	3.46	89.38	2.39
406	72	3.16	82.92	n.a.
408	68	2.90	98.20	n.a.
410	39	2.88	103.24	2.43
411	4	2.50	150	3.75
412	19	2.16	66.11	1.63
414	7	3.78	100	2.43
417	10	3.10	88.57	2.00
418	10	2.50	88.33	2.50
420	26	4.90	136.48	2.92
422	13	5.08	168.75	2.77
426	9	2.00	147.50	2.44
428	4	1.62	140	2.00
429	10	3.05	81.87	2.30

430	28	4.36	159.10	2.89
432	8	7.25	167.50	3.37
434	8	6.06	121.43	2.75
436	3	5.33	111.67	1.67
438	41	5.10	151.72	2.24
439	5	4.80	93.75	1.80
440	26	6.60	203.04	2.34
441	4	5.00	43.75	2.50
442	22	7.27	239.30	3.14
444	5	5.30	241.60	2.60
445	4	2.50	107.50	2.25
446	2	2.00	210.00	1.50

Note: Trips to WMU indicates the number of trips to each by WMU by the survey respondents. Avg. No of Days indicates the average number of hunting days within each WMU estimated to the nearest half day. The Avg. Mile Travelled indicates the average distance to the hunting area in miles.

Table B-31 Game Hunted and Harvested by Eastern Slopes WMU, Alberta Resident Sheep Hunters, 1981.

WMU	Antelope	Cougar	Deer Unsp.	Mule Deer	W.T. Deer	Elk	Goat	Moose	T. Sheep	N.T. Sheep	Bl. Bear	Gr. Bear
300			1/0	8/3	5/2	22/2		2/1				
302			13/2	11/4	11/4	33/1		1/1	11/0		6/1	
304		1/0	31/0	33/14	10/3	61/3		17/7	4/0		17/3	
306			8/0	7/2	2/0	7/1			2/0		1/0	
308			5/0	16/2	6/0	23/1	1/0	12/5	3/0		4/1	
310			7/0	3/0	5/1	11/0		5/4	1/0		5/1	
312			8/1	10/7	10/4	24/8		7/3	1/0		2/0	
316			2/0	3/0	2/0	2/0		7/2				
318			2/0	3/1		5/0		9/2	2/0			
324			4/1	3/1		3/0		5/2				
326			1/0			1/0		1/0			1/0	
328			2/1	1/0		10/2		5/1	1/0	1/1	2/1	1/0
330			5/0	2/1	1/0	5/1		5/1			3/0	
339					1/0			1/0				
340			11/1	2/0	1/1	14/2		11/4			2/0	
342			1/0			1/1		2/0				
344			7/1	1/0	1/0	4/0		9/3			3/0	
346			4/0	1/1		5/0		7/0			3/1	
352			1/0		1/1	4/0		6/1			2/0	
354			5/0	1/0	1/0	6/0		9/0			4/0	2/0
356					1/1	8/1		9/1	2/0		5/1	
400			28/2	30/5	3/0	88/8		5/2	107/5	4/1	20/1	
402			31/1	38/1	5/1	119/13		15/6	108/3	4/2	28/7	
404			2/0	3/1	1/0	71/7		6/1	40/1	6/1	9/1	
406		1/0	2/0	7/0	5/0	28/2		9/3	39/2		3/0	
408			4/0		1/1	20/3			53/0		1/1	
410			13/0	3/0	1/0	18/2		7/1	28/0	2/1	6/0	
411				3/1	3/0	3/0			1/0		3/0	
412			2/0	3/1	1/0	6/0		6/1	9/0			1/0
414			2/0	2/0		2/0		3/0	4/0			1/0
417			3/0	5/2		7/0		2/0			1/0	1/0
418				1/0		7/0			8/0		1/0	
420			4/0	6/1	4/1	22/1		8/0	13/0	1/0	1/0	
422						7/0		3/0	4/0		1/0	
426						3/0			6/1			1/0

428						2/0			3/0		1/0	1/0
429			3/0	2/0		5/1		4/1	2/0		1/0	
430			5/0	5/1		14/0		10/1	17/4	2/1	4/1	1/0
432						1/0			8/2			
434			1/0			5/0			7/0	1/1		
436						1/0			3/0			
438			5/0	6/2	5/4	11/2	1/0	7/0	24/4	2/2	4/0	1/0
439			2/0	1/0		1/0		2/1	1/0		1/0	
440			3/0	4/0	1/0	4/0	1/1	2/0	10/1	5/2	6/0	1/0
441				1/0		3/0		1/0	1/0			
442						2/1	1/1		14/1	2/2	1/0	1/1
444						2/0	1/0		1/0		1/0	
445									4/2			
446				1/0		1/0	1/0					
TOTAL	0	2/0	225/11	226/56	87/24	704/62	6/3	220/55	549/29	30/14	153/16	12/1

Note: Deer Unsp indicates Deer unspecified, T. Sheep indicates Trophy Sheep while N.T. Sheep indicates Non Trophy Sheep. The game hunted / harvest statistics are presented in the form (number of trips hunted / number harvested). Thus a 11/9 under goat for a particular WMU indicates that there were 11 hunting trips for goat in that WMU and 9 goats were harvested.

Table B-32 Hunting Activty By Eastern Slopes WMU of Alberta Resident Elk Hunters, 1981.

WMU	Trips to WMU	Avg. No. of Days	Avg. Miles Travelled	Avg. Party Size.
300	18	2.78	52.4	1.44
302	22	1.95	94.8	2.59
304	25	1.86	81.75	2.48
306	3	2.67	120	4.00
308	13	1.85	66.11	2.69
310	5	1.20	73.00	2.00
312	16	2.65	29.37	2.25
316	4	2.75	65.00	1.50
318	3	6.67	63.33	1.67
324	1	3.00	150.0	1.00
326	2	2.5	80	3.0
328	5	2.8	78.00	2.20
330	6	1.67	185.8	2.17
339	10	2.7	133	2.78
340	8	2.69	87.86	2.50
344	4	5.00	21.33	2.75
346	22	3.09	169.5	2.91
352	11	2.50	179	3.00
354	10	12.25	123.2	2.60
356	12	1.75	66.08	2.25
400	32	4.32	52.84	2.21
402	33	3.12	72.22	2.42
404	10	3.60	84.37	2.30
406	19	2.89	84.72	2.37
408	8	1.50	71.00	2.12
410	13	1.61	70.00	1.92
412	1	3.00	80.00	3.00
418	2	2.50	120.0	3.50
420	2	2.50	125.00	3.20
426	2	4.00	40.00	2.50
429	1	4.00	70.00	3.00
430	9	3.78	102.20	3.00
432	1	1.50	120.00	4.00
437	1	1.50	15.00	1.00
438	7	4.36	97.86	1.71
440	6	2.00	52.83	1.83
442	2	3.50	45.00	3.00

444	5	3.50	206.00	3.40

Note: Trips to WMU indicates the number of trips to each by WMU by the survey respondents. Avg. No of Days indicates the average number of hunting days within each WMU estimated to the nearest half day. The Avg. Mile Travelled indicates the average distance to the hunting area in miles.

Table B-33 Game Hunted and Harvested by Eastern Slopes WMU, Alberta Resident Elk Hunters, 1981.

WMU	Antelope	Cougar	Deer Unsp.	Mule Deer	W.T. Deer	Elk	Goat	Moose	T. Sheep	N.T. Sheep	Bl. Bear	Gr. Bear
300				7/4	2/1	14/1					2/0	
302			5/0	7/0	5/1	20/0		1/1	2/0			
304			7/0	13/4	3/0	22/1		3/1			3/0	
306				1/0		3/0						
308			2/0	3/2	2/1	10/2		1/1			1/0	
310			1/0	3/1	3/0	2/0						
312			2/1	7/1	6/1	11/2		3/2			2/0	
316			2/0					4/1				
318			2/0			2/0		2/0				
324								1/0				
326			1/1	1/0		2/0		1/0				
328			3/1			4/0		1/1				
330			1/0		1/0	2/0		4/0				
339			6/0			10/1		8/0				
340			3/0	2/1		8/1		5/1				
344			2/0		1/1	4/0		1/0			1/0	
346			17/0		1/0	21/2		22/4				
352			1/0		1/0	5/0		7/2				
354			5/0			6/1		9/2			3/0	
356			5/0		1/1	7/0		8/0			4/0	
400			10/2	3/2	6/0	27/2		3/1	3/1		11/1	
402			6/0	11/1		26/2		4/0	5/0		6/0	
404						9/2		1/0	4/0			
406			6/0			17/1		2/1	3/0			
408						7/0				1/1		
410			3/0	4/0		8/0		1/0	4/0		1/0	
412								1/0				
418			1/0			2/1			1/0			
420			1/0			1/0						
426						2/0		1/0				
429						1/0		1/0				
430			4/0	1/1		6/1		6/1				
432			1/0			1/0		1/0			1/0	
437						1/0						
438			4/1			5/1		6/0			1/1	

440			1/0	1/1		1/0		4/0		1/1		
442						1/1				1/0	1/0	
444			1/0	1/0	1/0	2/0		2/0		3/0		
TOTAL	0	0	104/6	67/19	33/6	272/22	0	118/20	22/1	5/2	38/2	0

Note: Deer Unsp indicates Deer unspecified, T. Sheep indicates Trophy Sheep while N.T. Sheep indicates Non Trophy Sheep. The game hunted / harvest statistics are presented in the form (number of trips hunted / number harvested). Thus a 11/9 under goat for a particular WMU indicates that there were 11 hunting trips for goat in that WMU and 9 goats were harvested.

Table B-34 Hunting Activty By Eastern Slopes WMU of Alberta Resident Moose Hunters, 1981.

WMU	Trips to WMU	Avg. No. of Days	Avg. Miles Travelled	Avg. Party Size.
300	4	2.25	196.67	1.75
302	1	2.00	350	3.00
304	12	2.71	70.25	3.42
306	6	1.83	108.33	2.17
308	7	1.50	44.14	2.00
312	8	1.12	42.50	2.62
316	10	1.25	72.00	2.50
318	1	2.00	100	1.00
324	3	3.33	80.00	2.33
326	2	2.0	80.00	1.50
328	2	2.5	165	2.50
330	5	3.00	62.50	2.2
339	1	5.0	180	3.00
340	16	2.50	100.63	2.62
342	2	3.50	125.0	1.50
346	12	2.46	103.92	2.33
352	16	3.59	164	2.87
354	6	1.25	22	2.00
356	9	3.44	38.89	2.44
400	1	2.00	250	3.00
402	8	2.25	116.9	2.75
404	1	3.00	80.00	3.00
406	7	1.28	39.17	2.14
408	2	1.50	100	2.50
410	4	5.00	3.00	2.50
412	2	1.00	75.00	2.50
417	1	2.00	150	1.00
420	8	2.86	171.43	2.25
426	1	3.00	65.00	6.00
429	2	2.50	80.00	2.00
430	9	1.89	183.33	1.78
434	1	3.00	75.00	6.00
438	9	3.67	71.67	2.33
440	3	3.17	303.33	2.00
442	1	7.00	175.00	5.00
444	1	6.00	260.00	3.00
445	1	2.00	400.00	2.00

Note: Trips to WMU indicates the number of trips to each by WMU by the survey respondents. Avg. No of Days indicates the average number of hunting days within each WMU estimated to the nearest half day. The Avg. Mile Travelled indicates the average distance to the hunting area in miles.

Table B-35 Game Hunted and Harvested by Eastern Slopes WMU, Alberta Resident Moose Hunters, 1981.

WMU	Antelope	Cougar	Deer Unsp.	Mule Deer	W.T. Deer	Elk	Goat	Moose	T. Sheep	N.T. Sheep	Bl. Bear	Gr. Bear
300					1/1	3/0						
302				1/0		1/0						
304			1/0	11/3		7/1		5/2			2/0	
306				4/0		1/0		7/1				
308			2/0	1/0		2/0		4/0				
312			1/0			6/0		1/0				
316	1/1		8/1	1/0		2/0		2/0				
318				1/0		1/0		1/0				
324			3/0			3/0		3/0				
326			2/0			2/0		2/0				
328						1/0		1/0				
330			4/0			3/1		5/0				
339			1/0			1/0		1/0				
340			2/0	2/1	3/1	11/1		8/1	1/0		1/0	
342			1/0			2/0		2/0				
346			2/0		3/2	6/1		9/0			4/0	
352			3/0			1/0		15/1			3/0	
354						4/0		6/2				
356			5/0	1/1		6/0		9/1			1/0	
400				1/0		1/0						
402				2/0	2/0	8/0						
404						1/0				1/0		
406				1/1	1/0	4/0		1/0				
408						2/0						
410			1/0			2/1		1/0			1/0	
412				2/0				2/0				
417				1/0		1/0		1/0				
420			1/0	2/1	1/1	8/0		2/0	4/0			
426				1/0		1/0		1/0	1/0			
429			2/0			2/0		2/0				
430			2/0	2/0		6/0		6/1				
434						1/0			1/0			
438			2/0			1/1		4/0	3/0		1/0	
440				1/0	1/0	1/0		3/0	1/0			
442						1/0		1/0				

444						1/0						
445									1/0			
TOTAL	1/1	0	43/1	35/7	12/5	105/6	0	105/9	12/0	1/0	21/0	0

Note: Deer Unsp indicates Deer unspecified, T. Sheep indicates Trophy Sheep while N.T. Sheep indicates Non Trophy Sheep. The game hunted / harvest statistics are presented in the form (number of trips hunted / number harvested). Thus a 11/9 under goat for a particular WMU indicates that there were 11 hunting trips for goat in that WMU and 9 goats were harvested.

Table B-36 Spring Bear Hunting Activity by Wildlife Management Unit of Alberta Resident Grizzly Bear Survey Respondents, 1981

WMU*	Number of Respondents***	Total Trips Per Person	Days Hunted Per Trip Per Person	Miles Travelled Per Trip Per Person	Party Size Per Trip Per Person	Grizzly Bear Bagged		Black Bear Bagged	
						Total	Per Person	Total	Per Person
300	2	3.50	4.28	112.1	1.86	0	0.00	0	0.00
304	2	2.50	1.60	56.0	1.80	0	0.00	0	0.00
310	2	1.00	2.00	222.5	2.50	0	0.00	0	0.00
312	1	1.00	1.00	35.0	0.00	0	0.00	0	0.00
316	5	1.40	1.86	51.4	1.70	0	0.00	0	0.00
318	6	2.33	2.14	105.7	2.71	0	0.00	0	0.00
324	1	1.00	2.00	75.0	3.00	0	0.00	0	0.00
326	1	1.00	1.00	60.0	2.00	0	0.00	0	0.00
328	2	2.00	2.88	192.5	2.00	0	0.00	0	0.00
330	4	1.50	1.17	62.5	2.16	0	0.00	0	0.00
339	4	1.00	1.75	77.8	2.25	0	0.00	1	0.25
340	13	1.46	2.68	56.1	2.53	0	0.00	5	0.38
342	3	1.00	3.67	63.3	3.00	0	0.00	0	0.00
344	5	1.20	2.50	45.0	1.67	0	0.00	0	0.00
346	5	1.60	1.25	41.3	1.63	0	0.00	1	0.20
352	17	1.18	2.55	98.5	2.25	0	0.00	5	0.29
354	18	1.44	3.46	143.1	2.19	0	0.00	7	0.39
356	15	1.80	2.35	153.6	2.59	1	0.07	4	0.27
402	2	1.50	1.67	100.0	3.33	0	0.00	0	0.00
404	1	1.00	4.00	70.0	2.00	0	0.00	0	0.00
406	2	1.50	1.00	37.0	0.00	0	0.00	0	0.00
408	1	3.00	1.00	60.0	2.00	0	0.00	0	0.00
412	5	1.40	3.71	54.3	2.28	0	0.00	0	0.00
414	3	1.33	2.50	111.3	2.25	1	0.33	0	0.00
416	11	1.73	2.34	95.6	2.37	2	0.18	0	0.00
417	1	1.00	2.00	100.0	3.00	0	0.00	0	0.00
418	8	2.13	1.47	50.2	1.29	0	0.00	0	0.00
420	5	1.00	2.90	139.0	2.00	0	0.00	0	0.00
422	1	1.00	3.00	200.0	2.00	0	0.00	0	0.00
426	1	3.00	0.00	200.0	4.00	0	0.00	0	0.00
428	4	1.00	2.00	186.3	1.75	0	0.00	1	0.25
429	5	1.40	2.86	79.3	1.28	0	0.00	2	0.40

430	6	1.00	5.00	98.0	1.67	0	0.00	0	0.00
432	1	1.00	4.00	200.0	2.00	0	0.00	0	0.00
434	1	1.00	1.00	150.0	2.00	0	0.00	0	0.00
436	1	1.00	4.50	70.0	4.00	0	0.00	0	0.00
437	2	1.00	1.00	92.5	1.50	0	0.00	0	0.00
438	25	1.84	2.52	89.9	1.91	0	0.00	4	0.16
439	4	1.00	0.88	69.5	2.25	0	0.00	1	0.25
440	30	1.53	3.76	98.4	2.17	1	0.03	2	0.07
441	6	2.00	2.25	38.3	1.67	0	0.00	5	0.83
442	9	1.11	3.50	293.0	2.30	1	0.11	2	0.22
444	4	2.00	1.88	38.8	1.75	0	0.00	0	0.00
445	1	1.00	2.00	0.0	1.28	0	0.00	0	0.00
446	4	1.00	2.88	107.5	3.00	0	0.00	0	0.00
PROVINCE-WIDE310		3.32	2.69	114.9	2.12	8	0.03	101	0.33

Table B-37 Spring Bear Hunting Activity by Wildlife Management Unit of Alberta Resident Black Bear Survey Respondents, 1981

WMU*	Number of Respondents***	Total Trips Per Person	Days Hunted Per Trip Per Person	Miles Travelled Per Trip Per Person***	Party Size Per Trip Per Person	Black Bear Bagged	
						Total	Per Person
302	2	1.00	3.25	125.0	2.50	0	0.00
304	1	1.00	6.00	35.0	2.00	0	0.00
306	1	1.00	0.50	5.0	2.00	1	1.00
328	1	1.00	1.00	0.0	2.00	0	0.00
339	1	6.00	1.00	30.0	4.00	1	1.00
342	2	1.50	1.00	75.0	2.00	1	0.50
344	1	5.00	1.00	10.0	2.00	0	0.00
346	2	1.00	3.25	65.0	1.50	1	0.50
352	3	1.00	3.67	59.0	2.67	0	0.00
354	3	1.00	3.17	131.0	2.00	0	0.00
356	1	1.00	2.00	60.0	4.00	0	0.00
400	1	1.00	0.50	150.0	3.00	0	0.00
402	1	1.00	1.00	75.0	2.00	0	0.00
404	2	2.00	2.00	43.8	1.75	0	0.00
406	1	1.00	3.00	65.0	4.00	0	0.00
408	2	1.00	1.00	52.5	1.00	0	0.00
412	1	1.00	1.00	25.0	2.00	0	0.00
430	1	2.00	5.50	7.5	2.50	2	2.00
PROVINCE WIDE	76	1.75	2.10	80.6	2.11	19	0.25